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ABSTRACT

The Austin Collaborative for Mathematics Education (ACME) is a systemwide initiative to improve mathematics education in all elementary and middle school classrooms in the Austin Independent School District (AISD), Texas. The initiative, funded by the National Science Foundation, provides long-term, high quality professional development to build the instructional capacity of more than 2,000 AISD mathematics teachers. This evaluation describes ACME professional development in its second year of implementation. It focuses on the roles and teamwork of ACME professional development facilitators, teachers' experiences in ACME professional development, effects on teachers' knowledge and skills, and implementation of the ACME. Data were gathered through: (1) questionnaires completed by 237 teachers and 83 principals ; (2) interviews with 10 teachers, as well as administrators and ACME staff; (3) observations of professional development and 50 classroom mathematics lessons; and (4) examination of district documents. A key ACME strength was the way ACME core members work together and their vision of high quality standards-based professional development. ACME professional development provides many opportunities for teachers who engage in its activities actively. Some challenges were identified, mainly in finding ways to improve teachers' participation within the professional development sessions. Appendixes contain the teacher questionnaire, the teacher interview form, the principal questionnaire, the classroom observation guide and protocol, the post-observation interview guide, and other surveys and interview guides. (Contains 12 references.) (SLD)

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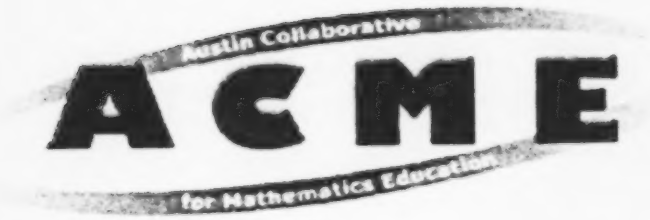
AUSTIN COLLABORATIVE FOR MATHEMATICS EDUCATION

1998-1999 Annual Report



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December 1999

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Austin Collaborative for Mathematics Education. 1998-99 Annual Report
Austin Independent School District

Executive Summary

The *Austin Collaborative for Mathematics Education* (ACME) is a systemwide initiative to improve mathematics education in all elementary and middle school classrooms in the Austin Independent School District (AISD). This initiative, funded by the National Science Foundation (NSF) and the district, provides long-term, high quality professional development to build the instructional capacity of over 2000 AISD mathematics teachers. ACME professional development supports teachers as they implement the district's curriculum resources of *Investigations in Number, Data, and Space* and *Connected Mathematics (CMP)*, which are aligned with the state standards for mathematics education in the Texas Essential Knowledge and Skills (TEKS) and the national standards set by the National Council of Teachers of Mathematics (NCTM). These standards focus on broadening the topics taught at all grade levels, developing children's mathematical thinking, and deepening children's conceptual understanding through concrete experiences (Russell, 1998). The standards contrast with traditional mathematics education characterized by rote memorization and computation practice.

District staff design ACME professional development to help teachers grow as a community of learners and to deepen their knowledge of mathematics content, pedagogy, and classroom management of standards-based mathematics instruction. AISD administrators expect every elementary and middle school mathematics teacher, including general education, special education, bilingual, and English as a Second Language (ESL) teachers, to participate in a coordinated series of ACME professional development activities. These activities include two years of summer institutes and follow-up days during the academic year.

To promote districtwide change in mathematics education, the ACME project bolsters leadership and the development of school cultures in which communities continually improve mathematics teaching and learning. ACME staff provide institutes for campus administrators to build knowledge of standards-based mathematics curriculum resources and instruction and to help campus leaders develop strategies for supporting teachers in implementation. ACME staff also work with other organizational structures in AISD that promote teacher leadership (e.g., curriculum specialists) to support the continuous improvement of mathematics education on campuses. In addition, the ACME project has customized professional development for teacher leaders so that they may facilitate sessions and support their peers on the campus level in a variety of ways, including peer coaching, demonstration teaching, and information sharing. To garner parent participation in the mathematics curriculum, the project staff provides schools with technical support (e.g., pamphlets and videos in English and Spanish) as well as assistance with organizing parent education and involvement (e.g., parent math nights). Additionally, the project staff enlists support from AISD's administrative leaders.

The purpose of this evaluation is to describe ACME professional development in its second year of implementation and to document changes since its inception. In particular, the evaluation focuses on (a) the roles and teamwork of ACME professional development facilitators, (b) teachers' experiences in ACME professional development, (c) effects on teachers' knowledge and skills, and (d) implementation of ACME.

Data were gathered through questionnaires completed by teachers and principals; interviews with teachers, ACME staff, and district administrators; observations of ACME professional development and of 50 mathematics lessons in AISD elementary and middle school classrooms; and examination of district documents.

ACME Professional Development Facilitators

Five categories of facilitators provided ACME professional development in the 1998-1999 school year and summer of 1999. The core ACME team provided the bulk of support to teachers and direction for the initiative. District mathematics staff supported the initiative by giving feedback to the core ACME team about the day to day realities of implementation and by facilitating ACME summer institutes. Facilitators from Michigan schools who piloted *CMP* in their classrooms provided summer institutes to middle school mathematics teachers. A consultant with Marilyn Burns Education Associates facilitated several sessions for a cadre of 30 elementary and middle school teachers. Elementary teachers who had participated in the cadre modeled lessons from *Investigations* for participants at ACME summer institutes.

Responsibilities of ACME team

The core ACME team provided districtwide leadership for the initiative. The main responsibilities of the ACME team were to design and implement ACME professional development, create resources for teachers such as assessment and planning tools, and organize materials for professional development. They developed collegial

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relationships with AISD teachers and administrators who participated in ACME professional development to support implementation. In addition, ACME team members provided campus support to eight pilot elementary schools, which involved modeling lessons, meeting with grade level teams, co-teaching, and mentoring teachers. Although some of these interactions were brief encounters that contained moral and professional support for implementation, the ACME team developed strategies that combined observation and professional conversations about children's thinking and pedagogy to help teachers improve their skills in standards-based instruction.

Teamwork

The ACME team addressed their own professional development as facilitators by attending conferences, sharing knowledge with team members through collaboration, and bridging on the expertise of others. Generally, team members improved their skills as facilitators. The ACME team reported that teamwork and collaboration were their primary source of support. The fuel for this teamwork was (a) a shared vision of reform in mathematics education through high quality professional development for teachers, meaningful mathematics for children, and the transformation of teaching culture into systemic, professional collaboration and (b) strong team leadership with a drive to constantly improve the quality of the work. The ACME team also received support from ample funding, a network of district specialists, and central office administrators, although support from campus administrators was mixed. ACME facilitators have become less defensive to the opposition to the initiative and more responsive to the needs of teachers who participate in professional development than before.

Recommendations for ACME professional development facilitators:

- **Continue to develop team support through collaboration and the drive to improve the work of ACME.**
- **Continue to enlist the support of campus administrators for standards-based mathematics education.**
- **Continue to address teachers' needs through responsiveness, but evaluate priorities.**

Teachers' Experiences in ACME Professional Development

Opportunities for Teachers

A key characteristic of ACME professional development was that facilitators designed sessions to address teachers' needs by providing sessions, for example, on how to plan lessons and model teaching investigations. This approach made teachers feel that facilitators improved follow-ups by listening to teachers. Teachers considered opportunities to share with their colleagues on campus and across the district to be an asset of ACME professional development. Some teachers had lively discussion about the implementation of standards-based curriculum resources, pedagogy, and mathematics content. Participating in ACME professional development also provided the opportunity for teachers to discuss standards-based pedagogy, content knowledge, and ways to foster children's thinking with ACME facilitators. Teachers also had opportunities to discuss and voice their concerns about district policies and practices concerning mathematics education at ACME sessions.

Teachers' Engagement in ACME Activities

The engagement of teachers in ACME professional development activities was not 100%. In observations, one-fourth to one-third of the tables had teachers who were not actively involved in the activities. Teachers who do not actively engage may be disgruntled or reluctant to participate in an initiative that they do not endorse. Some may be reticent in large groups, especially concerning topics new to them. Within ACME professional development sessions, facilitators may tackle low teacher engagement by communicating flexibility and expectations. Flexibility can create a context in which participants feel welcome to engage when they are ready and in whatever formats with which they feel comfortable. Facilitators' communicating the expectation that teachers will engage in activities within the session by asking probing questions and redirecting colleagues is another strategy for increasing what teachers take from sessions.

Other ACME Professional Development

Two professional development formats, campus support and teacher cadre, were offered to a small proportion of teachers who highly valued the opportunities. Teachers appreciated the mentoring and opportunities to talk with experts in standards-based instruction that campus support warranted. Although these interactions may pull teachers out of the isolation of teaching, it is important to note that reflective practice is necessary to improve instruction optimally. At teacher cadre meetings, teachers skilled in standards-based instruction could form professional relationships and engage in reflective discussions with similarly skilled colleagues. One shortcoming of these two professional development formats was that they touched few teachers in the district.

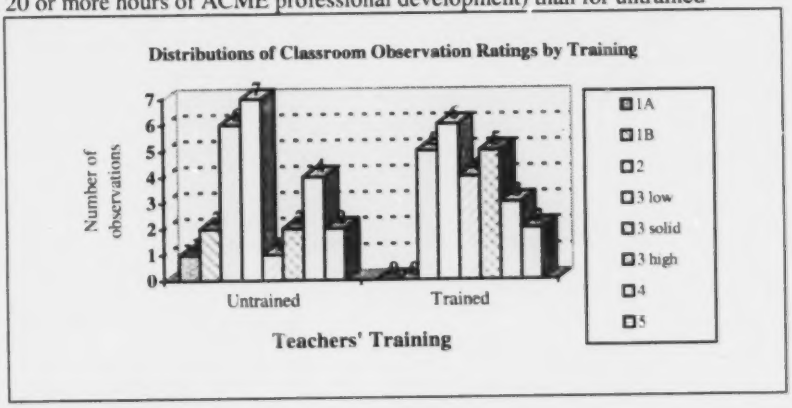
Recommendations for teachers' experiences in ACME professional development:

- Continue to provide high quality professional development in which teachers have opportunities to share with colleagues and experts in standards-based mathematics education.
- Address teachers' inactivity in professional development by asking engaging questions and communicating the expectation that teachers will participate.
- Continue to develop strategies of campus support that promote meaningful discussions and reflection about standards-based pedagogy that will help teachers improve instruction.

Effects on Teachers' Knowledge and Skills in Standards-Based Mathematics

Classroom Observations of Mathematics Instruction

Mathematics lessons were rated using the Classroom Observation Protocol (HRI, 1999b) on an 8-point scale ranging from *ineffective* to *effective* standards-based instruction (see definitions of ratings on p. 18 of report). Statistical analyses revealed less variability in the distribution of observation ratings and a trend of more effective instruction for trained teachers (i.e., 20 or more hours of ACME professional development) than for untrained teachers (i.e., less than of ACME professional development). However, number of professional development hours for teachers was not correlated with the observation ratings, which may be due to the different skills in standards-based instructions teachers have before they begin ACME. Features distinguishing effective and ineffective instruction were mathematics content knowledge and classroom culture.



Improving Teachers' Knowledge of Mathematics Content

ACME facilitators helped teachers improve their mathematics content knowledge by designing engaging problems for adult learners to solve that push teachers' understanding to higher levels. The ACME team also designed activities in which teachers develop their own computational strategies, analyze mathematics concepts in students' work, and encounter various topics such as measurement, algebra, and geometry infused throughout professional development activities. Although the ACME team tailored professional development activities to improve content knowledge, teachers did not have words to describe the content that they gained, especially teachers in elementary schools. Moreover, fewer teachers reported improvements in their mathematics content knowledge than did improvements in pedagogy and in the use of instructional materials. Assessment of the mathematics content knowledge that teachers gain in ACME professional development is lacking.

Improving Teachers' Knowledge of Pedagogy

To help teachers improve their knowledge of standards-based pedagogy and understand children's thinking, the ACME team launched various conversations in professional development. Facilitators modeled open-ended questioning strategies and asked teachers to talk about the approach, led book studies about pedagogy, discussed the instructional strategies and children's thinking in videos of AISD teachers skilled in standards-based instruction, and welcomed educators to reflect on their own teaching. The team also designed performance assessment rubrics and helped teachers learn how to implement them. These activities may be impacting teachers' knowledge of pedagogy. Teachers reported more standards-based instruction in their classrooms than in the previous academic year and articulately discussed the strategies. However, pedagogical knowledge does not necessarily transfer to pedagogical skills. Classroom observations of mathematics lessons taught by teachers who participated in ACME professional development reflected a range of skills in standards-based instruction.

Teachers' Learning How to Use the Instructional Materials

In the 1999-2000 academic year, all mathematics teachers will have their own standards-based curriculum resources, kit of manipulatives, and copies of student sheets because the AISD board of trustees agreed to fund these needs of teachers. ACME professional development activities that helped teachers learn how to use these materials included: (a) engaging in a scavenger hunt through the resources; (b) exploring games and the underlying mathematical concepts; (c) discussing investigations in follow-up sessions to teach in subsequent months; and (d) observing classroom teachers model teach lessons from the resources. What teachers valued about ACME professional development were the instructional materials and support for learning how to use them. Over

half of the teachers surveyed reported that participation increased their ability to implement high quality instructional materials, although some teachers found the resources repetitive and not meaningful.

Recommendations for improving teachers' knowledge and skills in standards-based mathematics:

- Focus on helping teachers learn more mathematics content knowledge; determine standards with which teachers are uncomfortable, set goals for tackling those concepts in professional development, and assess how well those goals were met.
- Continue to help teachers gain standards-based pedagogical knowledge; set up peer coaching networks on campuses to provide teachers observation and feedback on their instructional strategies.
- Continue to actively engage teachers with instructional materials and to have classroom teachers model lessons.

Implementation of ACME Professional Development

The ACME professional development model is on course such that all teachers of elementary and middle school grade levels will have the opportunity to participate by the Spring of 2002 when the NSF grant terminates. Attendance at summer and follow-up institutes in 1999 was less than 100%, with 80% to 90% of the teachers expected to attend participating in the first week and 75% participating in the second week of the institutes. High turnover in the district (i.e., about 60 new elementary teachers and about 20 new middle school teachers each year) and teachers' changing grade levels from year to year influenced the ACME staff to repeat institutes for all grade levels every summer. Because some new hires and other teachers missed summer institutes that they were targeted to attend, ACME staff held brief one-day overviews about standards-based mathematics in the first month of school. This professional development system appears to reach a majority of AISD mathematics teachers, not all.

Recommendations for sustaining professional development in standards-based mathematics:

- Establish summer institutes, follow-up during the academic year, and overviews for new hires at all grade levels that will continue after the NSF grant ends.

Austin Independent School District

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Figure 1. Frequency Distributions of Classroom Observation Ratings by Teachers' Training in 1999 18

OVERVIEW

In August of 1997, the Austin Independent School District (AISD) launched the Austin Collaborative for Mathematics Education (ACME) initiative to improve mathematics education in all elementary and middle school classrooms with standards-based curriculum resources and instruction. The National Science Foundation (NSF) funded the initiative, which receives support from the Charles A. Dana Center and the University of Texas at Austin. In the 1998-99 school year, the ACME project served over 2000 AISD educators who teach about 55,000 students at 68 elementary and 15 middle schools in a district of approximately 77,000 students (43% Hispanic, 18% African American, 37% Anglo and other; 50% receive free or reduced lunch and 13% receive bilingual or ESL services; AISD Office of Student Services, Sept. 1999). The ACME project is unique because it serves every elementary and middle school mathematics teacher in a large urban district with long-term professional development.

The ACME project builds the instructional capacity of all mathematics teachers by providing a minimum of 150 hours of professional development through summer institutes and follow-up sessions. Some teachers also participate in campus level support such as peer coaching, lesson modeling, and collaborative planning. The intent of ACME professional development is to build teachers' capacity to deliver effective mathematics instruction to all students, to ensure consistent implementation of quality mathematics curriculum resources across the district, and to provide ongoing support for teachers and administrators as they implement standards-based curriculum and instruction. Specifically, district staff design ACME professional development to help teachers grow as a community of learners and to deepen their knowledge of mathematics content, pedagogy, and classroom management for inquiry-based mathematics instruction.

AISD administrators expect every elementary and middle school mathematics teacher, including general education, special education, bilingual, and English as a Second Language (ESL) teachers, to participate in a coordinated series of ACME professional development activities. Participants begin their training with a summer institute lasting two weeks and continue with four to five follow-up days during the academic year. The second phase involves a three-day summer institute and three to four follow-up days. Teachers are paid a stipend to attend the summer institutes and follow-up sessions outside school hours, and substitutes are provided to release teachers during the academic year. To accommodate the needs of AISD teachers and administrators, ACME staff adjusted the original design of ACME by adding professional development sessions on Saturdays and evenings, designing sessions for special education teachers, and adding overviews for late hires. To address teacher turn-over (more than 500 new hires yearly), ACME staff repeated summer institutes for each grade level.

ACME professional development began working with teachers at the transition between elementary and middle school so that students would have consistent mathematics instruction from one year to the next. In the summer of 1997, fifth and sixth grade teachers began ACME professional development, followed by fourth and seventh grade teachers in the summer of 1998, second, third, and eighth grade teachers in the summer of 1999. Although kindergarten and first grade teachers will participate in summer institutes in the summer of 2000, ACME staff will introduce the standards-based curriculum resources to teachers of these grade levels in the fall of 1999 (because the resources are now the district's adopted texts). At most schools in the district, AISD is implementing ACME professional development by grade levels. Yet, at eight pilot

elementary schools, teachers of all grade levels participated in ACME professional development simultaneously. Three pilot middle schools participated in the NSF-funded State Systemic Initiative (SSI) beginning with sixth grade mathematics teachers in the summer of 1996. Pilot schools receive modified summer institutes: fewer days of summer institutes and follow-up sessions in exchange for on campus support such as modeling lessons and conversations about curriculum and instruction.

To support the mathematics instructional capacity of teachers, the district is implementing rigorous curriculum resources as part of the ACME initiative. The resources are based on standards set by the National Council of Teachers of Mathematics (NCTM, 1989, 1991, 1995), by the state in the Texas Essential Knowledge and Skills (TEKS), and by AISD's Mathematics Department in the local curriculum document. In the spring of 1999, the district adopted the curriculum resources of *Investigations in Number, Data, and Space* for elementary grades and *Connected Mathematics* (*CMP*) for middle grades, and purchased these materials to support teachers' implementation of standards-based instruction. AISD also adopted the resources of *Math in My World* (English version)/ *Mathematicas in Mi Mundo* (Spanish version) for elementary grades and *Mathematics: Applications and Connections, Courses 1-3* (English version)/ *Mathematicas: Aplicaciones y Coneciones, Cursos 1-3* (Spanish version) to supplement TEKS areas not addressed in *Investigations* and *CMP*. This adoption ensures that all of AISD's mathematics education resources and efforts are aligned with local, state, and national standards.

These curriculum resources of *Investigations* and *CMP* are particularly well suited for AISD because they support the following standards-based teaching practices:

- Promoting children's mathematical thinking, reasoning, and problem-solving skills;
- Developing children's deep understanding of mathematical concepts through concrete experiences, real-world problems, and communication; and
- Supporting a vertically and horizontally coordinated curriculum that addresses the needs of all students, including those who are special education, limited English proficient, bilingual, and gifted and talented (Russell, 1998).

These practices emphasize children's mathematical literacy by promoting the understanding of mathematics concepts and approach instruction through problem-solving and communication of ideas. These practices contrast with traditional practices that emphasize mathematical algorithms, rote memorization, and computation mastery (Cohen & Ball, 1990).

To promote districtwide change in mathematics education, the ACME project bolsters leadership and the development of school cultures in which communities continually improve mathematics teaching and learning. ACME staff provide institutes for campus administrators to build knowledge of standards-based mathematics curriculum resources and instruction and to help campus leaders develop strategies for supporting teachers in implementation. ACME staff also work with other organizational structures in AISD that promote teacher leadership (e.g., curriculum specialists) to support the continuous improvement of mathematics education on campuses. In addition, the ACME project has customized professional development for teacher leaders so that they may facilitate sessions and support their peers on the campus level in a variety of ways, including peer coaching, demonstration teaching, and information sharing. To garner parent participation in the mathematics curriculum, the project staff provides schools with technical support (e.g., pamphlets and videos in English and Spanish) as well as assistance with organizing parent education and involvement (e.g., parent math nights). Additionally, the project staff enlists support from AISD's administrative leaders.

EVALUATION DESIGN

The purpose of this evaluation is to describe ACME professional development in its second year of implementation and to document changes since its inception. The information was gathered according to the evaluation design of Horizon Research, Inc. (HRI) and supplemented with other structured and unstructured data gathered locally (Batchelder & Christian, 1999). The major sources of information included AISD mathematics teachers, principals, central office administrators, district mathematics staff, and documents as well as observation ratings.

Teacher Questionnaires

A random sample of 300 AISD elementary and middle school mathematics teachers were sent questionnaires. Twenty-four teachers were omitted from the sample because they were not currently teaching mathematics in the classroom (i.e., they taught language arts and social studies only, were on personal leave, or had resigned). Of the 276 eligible teachers, 237 returned valid questionnaires with a return rate of 86%. For these 237 teachers, most (88%) were female, more than half were White (59% White, 30% Hispanic, 7% African American, 1% Asian or Pacific Islander, and 4% other or unknown), most (95%) had completed 2 semesters or more of college mathematics but only some (23%) had completed 5 semesters or more, and about one-third (34%) had taught school for 5 years or less, one-third (29%) had taught for 6 to 15 years, and one-third (37%) had taught for 16 years or more.

For the purposes of this evaluation, teachers were defined as trained when they had attended at least 20 hours of ACME professional development (HRI, 1999a). According to questionnaire responses, half of the teachers surveyed were trained and half were untrained.

The HRI questionnaires surveyed teachers' beliefs about mathematics instruction, preparation, classroom practice, mathematics content knowledge, perceptions of district support, and experiences in ACME professional development (see Appendix). The results of the 1997-98 survey suggested that teachers did not distinguish ACME professional development from other professional development provided by the district (i.e., teachers reported more hours of professional development than ACME had offered at the time). Consequently, to improve the reliability of responses, each questionnaire was affixed with a statement specifying that items about professional development referred to "ACME training in *Investigations* and *CMP*."

Teacher Interviews

Additional information about the project was gathered through interviews with 10 mathematics teachers randomly drawn from the previous sample of 300 teachers. (The evaluation design initiated these interviews in the project's second year.) The 10 randomly selected teachers taught 2nd through 5th grades, and half were 4th grade teachers. All 10 of these teachers were trained, and all but one had participated in 30 or more hours of ACME professional development. The lead evaluator conducted all interviews over the phone. The interviews, designed by HRI, included teachers' thoughts and feelings about ACME professional development, the presence or absence of changes in their teaching practice, their needs to improve mathematics instruction, and school and district policies that facilitate or hinder reforms in mathematics education (see Appendix).

Principal Questionnaires

In the spring of 1998, all AISD principals of the 15 middle schools and the 68 elementary schools completed questionnaires about standards-based mathematics and science curricula, ACME professional development, and school characteristics (see Appendix). Forty-two percent of the respondents had held the position of principal for 3 years or less and about two-thirds of the respondents had held the position of principal at the school or in AISD for 3 years or less. As with the teacher questionnaires, each principal questionnaire included a statement specifying that items about professional development referred to "ACME training in *Investigations* and *CMP*."

Classroom Observations

From the sample of 300 mathematics teachers, certified evaluators observed the mathematics lessons of 50 randomly selected teachers. Ten additional teachers were contacted, but they did not participate in the observations for various reasons (e.g., not currently teaching mathematics, on personal leave, or too busy). As March of 1998, the ACME project records indicated that the number of ACME professional development hours that the 50 observed teachers had participated in ranged from 0 to 128 hours with a mean of 33.7 hours. Twenty-five observed teachers were considered untrained (i.e., had participated in less than 20 hours of ACME professional development), and 25 observed teachers were trained (i.e., had participated in 20 hours or more). The observation rating for one untrained teacher was omitted from the statistical analyses because his background was not representative of that group; he had a doctoral degree in mathematics education with a specialization in constructivist pedagogy. Most lessons sampled (86%) were in elementary classrooms, and the mode was fourth grade classrooms (n=13).

To conduct 50 classroom observations, district evaluation and ACME project staff were trained and certified to rate classroom observations reliably using the HRI Classroom Observation Protocol (HRI, 1999b; see Appendix). Observers rated lessons on a 5-point ordinal scale, which ranged from *ineffective* to *exemplary* instruction on the basis of current standards for mathematics education. The purpose of sampling 50 mathematics classrooms was to gather data that were more representative than the 10 required observations conducted the previous year.

Professional Development Observations

The lead evaluator observed 11 ACME professional development sessions and formally rated five sessions with the HRI Professional Development Observation Protocol (HRI, 1999c; see Appendix). Similar to the classroom observation protocol, observers rated sessions on a 5-point ordinal scale, which ranged from *ineffective* to *exemplary* professional development facilitation. Observations lasted one to two hours.

The observations covered a variety of ACME professional development activities. The five rated observations included the following: (a) a fourth grade and a seventh grade follow-up sessions during the school year; (b) a third grade summer institute session in which a classroom teacher modeled a lesson from the *Investigations* instructional materials; (c) a campus support visit made by a professional development facilitator; and (d) a seventh and eighth grade summer institute facilitated by an experienced Michigan trainer who had piloted *CMP* in her classroom. The informal observations of ACME professional development included the following: (a) a fifth grade follow-up session during the school year; (b) a "sneak preview" during the school year to provide information about ACME professional development for second and third grade teachers

who would begin participating in the summer of 1999; (c) a summer institute session on peer coaching with pilot school teachers; and (d) sessions with the teacher cadre, a group of trained teachers that ACME staff recognized as motivated to improve their own standards-based mathematics instruction and as leaders in reform.

These sessions were selected because they represented: (a) the foundation of ACME professional development (i.e., week-long summer institutes and follow-up days during the school year); (b) teachers at all phases of participation in ACME professional development (i.e., from fifth grade teachers who initiated the project in the summer of 1997 to the most recently added cohort of third and eighth grade teachers); (c) elementary as well as middle school sessions; and (d) a variety of support services (e.g., on site support and peer coaching).

Additional Sources

Additional sources of information include interviews with district and ACME project staff, observations of district and project meetings, district and state mathematics curriculum documents, professional development materials, brochures, letters, and newsletters.

RESULTS AND DISCUSSION

ACME PROFESSIONAL DEVELOPMENT FACILITATORS

Five Categories of Facilitators

Core ACME Team Facilitators

In the second year of the project, ACME professional development facilitators fit into five categories. Five ACME mathematics specialists and one administrator made up the core of the ACME team. These facilitators were paid through the NSF grant, and provided the bulk of support to teachers and direction for the initiative. All ACME team members were former classroom teachers who were leaders in standards-based curriculum and instruction on their campuses, and some members had held administrative positions. Many ACME team members had previously provided professional development about standards-based mathematics curriculum and instruction to other teachers on their campuses and for district, state, and national organizations.

District Facilitators

A second category of professional development facilitators were three mathematics specialists and one administrator hired by the district whose main responsibilities were to enact district policies and practices. These district staff supported the initiative by working with teachers and principals on campuses, by observing the day to day realities of implementing the curriculum resources, and by giving feedback to the ACME team. During the summer when work on campuses decreased, the district mathematics specialists and administrator helped provide ACME professional development. The AISD Mathematics Supervisor lead both the ACME team and the district mathematics staff. An additional facilitator served as a liaison between AISD and the Dana Center at the University of Texas.

Middle School Facilitators

Another category of professional development facilitators provided summer institutes to middle school mathematics teachers. Each year of the ACME project, ACME staff has hired a group of facilitators from Michigan schools who piloted *CMP* in their classrooms. These facilitators have extensive experience providing professional development to help teachers across the nation implement standards-based curriculum resources of *CMP*. The core team of ACME facilitators, on the other hand, provides follow-up professional development during the school year to all middle school mathematics teachers.

Teacher Cadre Facilitators

Two other categories of ACME professional development facilitators center on advancing teacher leadership in standards-based mathematics education throughout the district. In the second year of the ACME project, ACME staff hired a consultant with Marilyn Burns Education Associates to facilitate several sessions for a cadre of 30 elementary and middle school teachers who were highly motivated to implement standards-based curriculum resources in their classrooms and expressed deep understanding of standards-based pedagogy. These sessions focused on topics such as developing one's own professional development project, promoting student discourse in the classroom, and cognitive coaching. From this teacher cadre, ACME staff selected another group of professional development facilitators. In summer institutes, elementary

classroom teachers who had participated in the teacher cadre professional development joined facilitators of the core ACME team and modeled lessons from *Investigations* for participants.

Roles of ACME Team Members

As ACME professional development facilitators, ACME team members were leaders in the district's initiative to improve mathematics education with standards-based mathematics, both on and off campus. The symbolic move of leaving the classroom and being hired by the district's Mathematics Department communicated their leadership roles. The demands placed on ACME staff and their own personal motivation to reach teachers and enact change in mathematics education bolstered their roles as leaders of the initiative and the district's mathematics program.

Professional Development Responsibilities

The core ACME team provided most of the ACME professional development to teachers and other district staff at the district's Professional Development Academy and on campuses. They designed ACME professional development activities and adapted pieces from other workshops and sources. These pieces centered on state and national standards for mathematics instruction, mathematics content, pedagogy, and the implementation of ACME curriculum resources. They developed other resources for teachers, such as assessment tools and accompanying professional development pieces, and generated documents to support teachers' implementation of the ACME curriculum resources, such as charts that showed correlations between the investigations in the resources with the state standards (TEKS). ACME facilitators also "haul materials...and organize manipulatives," as one team member described; the job was "labor intensive." Additionally, through ACME professional development, ACME team members developed collegial relationships with district teachers and principals. For example, one ACME facilitator received a call on the thirteenth day of school from a teacher who had participated in a recent summer institute reporting with excitement that "her kids were finally learning math and were talking more about math." Thus, ACME professional development facilitators provided teachers and district staff with material resources and one-on-one support for implementation.

Campus Support

In the second year of the ACME project, several ACME facilitators also supported teachers on campuses, especially at pilot schools. About twice a month, ACME team members visited these campuses to model teach, meet with grade level teams, co-teach, and mentor teachers. As one facilitator explained, these encounters were opportunities to "trouble shoot, listen to them talk about what's going right, a time for reflection." Often these encounters entailed what one facilitator called "meaningful minutes," or brief interactions to share information about curriculum and instruction. Brief encounters with colleagues are common for educators whose workdays are focused on children (Lieberman, Saxl, & Miles, 1988).

In one observation of campus support, many of these encounters were like touching base with teachers and providing moral and professional support for implementation of standards-based mathematics resources. Some teachers dug deep into how children's actions and thinking had changed in their classrooms since the implementation of standards-based curriculum resources. However, in one brief encounter, the evaluator observed an educator who seemed to nod his head to standards-based mathematics curriculum and instruction while declaring himself a traditional mathematics teacher. The facilitator appeared to overlook the dissension in his

words and perhaps missed an opportunity to explore why he chose traditional instructional strategies and to suggest alternative approaches. A drawback of these brief interactions is that opportunities to influence change, particularly among educators who are hesitant about implementing standards-based mathematics, may be lost. Influencing change requires complex, in-depth interactions.

Over the course of the year, ACME team members tried to develop conversation strategies that would influence change by helping teachers improve their mathematics instruction in meaningful ways. One facilitator realized that visiting teachers' classrooms to observe their instructional strategies was a threatening format and detracted from constructive professional conversations. She decided to try teaching a mathematics lesson in a teachers' classroom, having that teacher observe, and then discussing what the teacher saw the students doing and saying. The subsequent exchanges were about children's thinking and the facilitator's instructional strategies—not the teacher's instruction—and consequently were meaningful. This example demonstrates how the ACME facilitators pushed their own practice to arrive at the same end goal for educators as they intend to offer children: a deeper understanding through negotiated meaning in a non-threatening context.

Preparation of ACME Team Members

Attending Conferences

ACME project staff made several different efforts to improve their knowledge and skills as professional development facilitators and leaders of mathematics reform. To build a foundation of professional growth, ACME team members attended various conferences across the nation to gather information and learn about what other professionals were doing to improve mathematics education such as the annual meeting of the National Council of Staff Development (NCSD), the Technical Educational Research Center (TERC) leadership conference, and the NCTM annual conference. The team appeared to put into practice what they had learned at these meetings through collaboration. Typically, what one team member learned was shared with the others. For example, at NCSD, one team member learned about a professional development strategy for empowering participants: In this strategy, participants explain their goals for a workshop and the facilitator matches the day's agenda and organizes "dialogue groups" around those goals. The team adapted this approach to their own work with teachers. Another team member attended a two-week seminar at Developing Mathematical Ideas (DMI) to deepen her mathematics content knowledge. A few weeks later, she held a professional development meeting with the ACME team and mathematics staff to share what she had learned. Thus, information that team members gathered from outside sources was routinely exchanged with other members to enhance the ACME project. This collaboration reinforced the team's commitment to ensuring consistency across ACME professional development for teachers: All teachers benefited from the knowledge of all ACME facilitators.

Bridging on Others' Expertise

ACME team members also sought professional growth by bridging on the expertise of others. New team members were oriented to ACME professional development by observing seasoned team members facilitate sessions and working with other members on specific projects. Before conducting their own sessions, new members co-facilitated sessions with experienced ACME team members. Contacting professional development providers at other sites was another vehicle for improving skills. Two new ACME team members were preparing to provide

campus support to teachers for the upcoming academic year. Not only did they consult with the team members who had provided this support the previous year, but they also met with a mathematics specialist from a New York City school district to discuss the strategies for campus support that she had developed. Thus, bridging on the expertise and skills of others was common practice for ACME team members.

Improvements in the Quality of ACME Professional Development

On the basis of professional development observations, the quality of ACME professional development generally improved as the providers honed their skills. Overall, the average rating of professional development observations for this year was higher than the average overall rating of the baseline year of the ACME project (Batchelder, 1998). In the baseline year, the average overall rating of ACME professional development on the HRI protocol was 3.6, which indicated the *beginning stages of effective professional development* in which sessions are somewhat limited in likelihood to enhance the capacity of teachers to provide high quality mathematics education (HRI, 1999c). In the present year, the average rating of ACME professional development was 4.1, which indicated *accomplished, effective professional development*, which should affect the capacity of most participants to provide high quality mathematics education (HRI, 1999c). In particular, the delivery of mathematics content improved from a rating of 3.4 in the baseline year to 4.0 in the current year of the ACME project. However, these improvements may be artifacts of differences in the two samples: In the baseline year, all ACME team facilitators and district mathematics specialists were observed, whereas in the current year, a small number of facilitators were observed in a variety of settings.

In the span of one year, ACME team members grew in their capacity to facilitate professional development at different rates. In one observation, for example, a facilitator appeared more relaxed and confident than she had been earlier. This confidence was reflected in her interactions with participants. She appeared more responsive to teachers than before such that she let participants do the talking in a large group discussion, listened, and summed up their ideas accurately. This approach contrasted with her performance the previous year when she lead the discussion and provided most of the ideas. Another facilitator softened her interactions with participants, but at times appeared not to address teachers as peers. Thus, the degree of improvement varied across ACME professional development facilitators.

Support for the ACME Team

Sources of support for the core group of ACME professional development facilitators included the ACME team itself, its leadership, and other district administrators.

Team Spirit

An outstanding characteristic of the core group of ACME professional development facilitators in the second year of the ACME project was team spirit. As one facilitator explained, "I couldn't do it without the team...I collaborate with team members on everything; I don't have to do anything by myself." Although members brought different skills and knowledge to the ACME project, it was the process of communicating and sharing ideas as a team that promoted professional growth. One facilitator considered her most important professional development experience to be "meeting with the team, discussions, talking about making [professional development for teachers] better." In the summer of 1999, team members talked at lunch informally about the professional development sessions they were facilitating. One teacher cadre member who worked with the ACME team said that she never realized how much thought,

effort, and concern went into planning ACME professional development. Thus, the team members adopted the constructivist principles of collaboration and communication as means of continually improving ACME professional development. This collaborative effort provided what some team members considered their primary source of support and professional development.

Integral to the ACME team spirit was the vision for reforming mathematics education in the district. Team members generally agreed that the purpose of the initiative centered around implementing standards-based mathematics curriculum resources in classrooms and having an impact on teachers districtwide. They agreed that ACME professional development should be ongoing and should provide opportunities for teachers to improve their mathematics content knowledge and to adopt standards-based pedagogy. One team member emphasized children's experiences more than that of teachers. She stated that the ACME project was "about meaningful mathematics for kids, mathematics that is non-threatening and useful for kids." Another team member took it a step further and asserted that the "overall goal was to change the way we've thought about teaching mathematics, to change the way we've thought about the culture and structure of teaching;... to dislodge the thinking, it's not an individual effort; it's a group effort of schools and the district." Pulled together, these ideas suggest a plan for mathematics reform and seemed to fuel the team's concerted efforts to support teachers.

Team Leadership

The ACME project leader was another primary support for ACME team members, and infused the team with a drive to constantly improve the quality of their work. The level of collaboration that ACME team members had achieved by the summer of 1999 was related in part to the ACME team lead's efforts to learn from the highly experienced group of professional development facilitators from Michigan. At the end of the ACME project's first year summer of 1998, the ACME leader appeared to be concerned about the quality of professional development that the ACME team provided and sought ways to improve their skills and strategies for working together. That summer, when the Michigan group was facilitating professional development for AISD middle school mathematics teachers, the ACME leader observed how they worked individually as facilitators and as a team. At the end of each day, the Michigan facilitators discussed their work by problem-solving and trying to figure out how to improve the sessions to meet teachers' needs. Although the ACME team had established a system of reviewing teacher evaluation forms concerning ACME professional development, they generally processed the feedback as judgments or complaints rather than as problems to solve. The ACME director returned to her team in the fall to refocus the conversations about professional development and to improve their work by listening to what teachers were saying. This example also demonstrates the adaptability and the climate of improvement through learning of the ACME team's leadership.

Other Administrative Support

In general, ACME professional development facilitators reported that in addition to team work and the ACME team leadership ample funds supported their efforts to promote standards-based mathematics in the district; the ACME facilitators "want for nothing." Additionally, within in the district, they had a "network of people to call," such as specialists in staff development. Central office support affected the work of the team lead directly and was filtered down through the ACME team lead. Support from campus administrators, however, was mixed. Whereas one principal sought help from ACME team members to put a plan in place to support teachers who were implementing standards-based resources, another questioned the ACME team,

curriculum resources, and standards-based instructional strategies often. ACME team leaders, on the other hand, who provided professional development directly to campus administrators, reported that many were enthusiastic and wanted to learn more about what they could do to support the initiative and teachers on their campuses. Thus, in the second year of the ACME project, support for ACME team members was strong, but not complete on all fronts.

Changes in the ACME Team

The ACME team's drive to constantly grow professionally has resulted in changes in how the team works with teachers, other district staff, and the community. In the first year of the ACME project, the team had adopted the metaphor of a "breastplate" to protect themselves from the onslaught of attacks from people who were opposed to the ACME initiative or reluctant to participate. In its second year, ACME team members took off the breastplate because they no longer needed it. They had softened from a defensive posture to a receptive, open posture; they listened to teachers more and talked at them less than before. Teachers themselves remarked these changes in the ACME team's attitude. One teacher stated, "In the beginning everyone was defensive; they [facilitators] put energy into it, at latter [sessions], they acknowledged weaknesses, listened to your thoughts; that was great...; the new attitude of ACME staff is wonderful."

This evolution in the ACME team's approach to teachers reflects the integration of another constructivist principle into ACME professional development: The ACME team has moved from a unidirectional to a bidirectional approach in their work with teachers. As one ACME team member explained, "We've evolved in our goal, the team one year ago said, 'This is what teachers need,' so now we're asking, 'What do teachers want? What is important to them?'" With this change in approach, the team has devised a separate professional development session for special education teachers, for example, which was hailed as a unique opportunity because their needs for implementing standards-based mathematics were not met in other sessions.

Another example of the team's responsiveness to teachers was the development of a packet for kindergarten through eighth grade teachers that included (a) recommended unit sequence for the implementation of AISD curriculum resources; (b) charts that correlate the TEKS state standards for mathematics with the AISD adopted curriculum resources; and (c) lists of the mathematical content emphasis of those resources with strategies for differentiation for gifted and talented, special education, and bilingual/ESL students. Another example of how the team responds to the needs of teachers was to garner financial support from the district to alleviate the time elementary teachers spent making copies of student sheets for investigations. In the fall of 1999, all teachers will receive shrink-wrapped stacks of student sheets for their classes.

TEACHERS' EXPERIENCES IN ACME PROFESSIONAL DEVELOPMENT

Many teachers who participated in ACME professional development had positive attitudes about its quality. Among the teachers surveyed, 57% rated the overall quality of ACME professional development as "good," "very good," or "excellent;" 33% rated it "fair," and 10% rated it "poor" or "very poor."

Addressing Teachers' Needs

In the second year of the ACME project, teachers' experiences in ACME professional development reflected the ACME team's focus on listening to and addressing the needs that teachers expressed. As one teacher explained, "The people are trying to gear next time so that it's better for you, makes you know you're being heard." In several observations, the design of ACME professional development catered to the needs of teachers. The facilitator of one fifth grade follow-up session organized the "dialogue groups" previously mentioned around goals teachers set at the beginning of the session. The topics teachers selected included applications of computer technology to investigations, assessment strategies that teachers generated, and differentiation for special education students. In another observation, the design of ACME professional development directly addressed middle school teachers' request to learn how to plan *CMP* lessons. The teachers devised a standard and applied it to the planning of one unit. Additionally, the ACME team brought in classroom teachers to model lessons, because many elementary teachers said that they wanted sessions on "Here's how to do lessons." Thus, these examples illustrate a few of the adaptations that the ACME team made to professional development to accommodate teachers.

Opportunities to Share with Colleagues

In a recent case study of nine AISD schools (Batchelder & Christian, 1999), teachers cited opportunities to share ideas about implementing standards-based mathematics curriculum resources with colleagues as one of the most beneficial experiences of ACME professional development. As one teacher stated, "It gives you opportunities to talk with colleagues on your campus and others; it gives you a good impression of what's going on." In one of the dialogue groups previously mentioned, special education teachers exchanged ideas about pedagogy and applications of standards-based curriculum resources with their students. Some of the ideas that these teachers expressed during the professional development observation follow:

- Some special education students fit well with *Investigations*, some students do not.
- In cooperative groups, kids tutor kids. Teaching can help them with individual work.
- Because the curriculum involves student-directed rather than teacher-directed learning, special education students are successful.
- *Investigations* is difficult to read and convoluted.
- Fifth grade special education kids can do third grade exercises at third and fourth grade level, then through inclusion students understand the mathematics in the fifth grade class.

This example illustrates how ACME professional development provided teachers opportunities to discuss their thoughts about using the curriculum resources with their students and specific strategies that they used. Noteworthy is the willingness of teachers to express praise as well as discontentment for the resources and instructional strategies.

In the professional development observation of middle school teachers planning a *CMP* lesson, participants dug deep into mathematics content and pedagogy. Many teachers from the same campuses and from campuses across the district had lively discussions and collaborated actively in planning. In this session, the observed teachers talked about possible directions to take the mathematics and got excited about the ideas of other teachers. They proposed additional

problems with similar content that students could solve. The discussion of mathematics content flowed naturally into pedagogy. Teachers discussed what they thought about putting right and wrong answers on the board and how the practice had worked with their students. They also suggested follow-up questions to ask for that lesson. A majority of the teachers in the session appeared to learn a great deal about how to use the curriculum resources with their students.

Opportunities to Share with ACME Facilitators

Additionally, teachers had opportunities to share ideas about mathematics instruction with facilitators in ACME professional development. In the observation of middle school follow-up just described, teachers benefited from the facilitator's probing questions and knowledge of the curriculum resources. While discussing the lesson with a colleague and the facilitator, one teacher brought up the point that a probability is always between zero and one and gave the following example, "If you throw a ball up, it won't stay in the air." The facilitator asked the participant, "Is that something that you'll need to pull out because it's not in the actual investigation?" This question pushed the teacher to consider how he could present the concept to students, for example, with a scale from zero to one. This dialogue not only pushed thinking of this educator further, but it also gave other teachers ideas of instructional strategies to pursue with students.

In another observation of professional development of fourth grade follow-up, an ACME facilitator discussed ways to help children multiply by clustering with a small group of participants. The discussion focused on how children would approach the problem, particularly special education students. One teacher said, "One child in my class still has trouble reasoning." The facilitator suggested an alternative way to solve the problem and said, "Would he get it this way? If he's not getting it this way, he's building on these other concepts here." Another teacher at the table said, "It's easy if you're teaching kids who have good number concept." The facilitator suggested, "Well can he count by tens." In this example, teachers were unsure about helping some children successful solve problems with clustering. The facilitator tried to help the participants think about how the strategy could be useful by suggesting different approaches, and by connecting to approaches to the problem with which the student may be familiar.

ACME professional development also established a venue where teachers could learn about district mathematics policy and practices directly from ACME facilitators, who were central office staff, and voice concerns. For example, when the district adopted two mathematics curriculum resources in the spring of 1998, ACME facilitators clarified district policy: *Investigations* and *CMP* were the main curriculum resources that teachers would use and the supplemental texts were adopted to fill in state standards (TEKS) that the other resources did not cover. One teacher asked why the books were selected, and an ACME facilitator who had been on the selection committee explained the rubric used to evaluate resources and the process of documenting their ratings. A few teachers aired frustrations about having two adopted resources and their difficulties using *Investigations*. Other teachers articulately promoted standards-based resources. Thus, the interaction between teachers and ACME professional development facilitators went beyond learning about instructional strategies and materials, which yielded positive results. On the basis of open discussions like this one, the ACME team decided to develop materials such as charts that correlate the TEKS standards with all AISD adopted curriculum resources.

Teachers' Engagement in ACME Professional Development

Incomplete Teacher Engagement in Activities

Although ACME professional development provided teachers with opportunities to explore standards-based curriculum resources and instruction, in the second year of the ACME project, as in the baseline year, participation was not 100%. Among the teachers surveyed who had attended ACME professional development, 68% reported that they had participated in an ACME discussion group during the academic year at least once, and 44% had participated in a discussion group three or more times. Because all ACME professional development involved small and large group discussions, every teacher who attended sessions would have been invited to participate in discussion groups with other teachers. These percentages correspond to professional development observations. In more than one observed session, one-fourth to one-third of the tables had teachers who were not actively involved in ACME professional development activities. In the observation of the middle school session described previously, for example, nine out of 12 participants actively engaged in the activities. Some teachers attended but appeared to be punching the clock. During various observations, one teacher was observed reading a newspaper, another was making paper airplanes, and still another was looking at a history text.

Certainly, in any initiative that asks some to change their current practice and intends systemwide participation, disgruntled participants will surface. One AISD teacher stated that she disliked the amount of time spent in professional development and said, "It's more than what's necessary, the 8 hour span. They come up with 8 hours of activities, but the material could be covered in half the time. My gut feeling is that that's the number of hours with the grant, but a lot of them are not necessary." This teacher did not want to invest the time in ACME professional development and did not find value in many of the activities. Some teachers were disgruntled or reluctant to implement standards-based mathematics in their classrooms (see examples in Batchelder & Christian, 1999). It is also possible that some teachers do not participate in ACME group discussions because they may be timid about speaking in large groups, particularly about a topic new to them.

Facilitators' Adjustments to Incomplete Teacher Engagement in Activities

In response to the objections of some teachers, the ACME team changed their approach to teacher participation from "required" to "expected." (In the first year of the project, additionally the teachers' union pointed out that attendance could not be required because participation was not specified in teachers' contracts.) The ACME team members also reflected on what they could do to make teachers want to attend to ACME professional development. They decided to make explicit to teachers and administrators what participants would gain by participating, for example, in a "sneak preview" session for new participants.

Although encouraging teachers to attend ACME professional development does not guarantee that teachers will engage in the activities. Flexibility and expectations are two strategies for engaging participants. Flexibility to engage in activities may open up the field and make more teachers feel welcome to participate. One facilitator introduced a summer institute with a sharing exercise in which people told stories about something that was unique about themselves and invited other people to build on the stories by pointing out commonalities between themselves and others. Rather than going around the room and insisting that everyone participate, she let those teachers share who wanted to and then flowed naturally into the next

activity. This approach took the pressure off those participants who did not want to share personal stories and maintained a welcoming atmosphere.

However, flexibility to engage in activities should not preclude communicating the expectation that attendees will participate in the day's events. In professional development observations, some ACME facilitators appeared at times to ignore or overlook tables of teachers who did not actively engage in the activities. Perhaps a question or redirection would have pushed teachers to engage actively. Facilitators could also make on the spot decisions to pair inactive participants with active ones. In one observation, for example, half of the small groups were more active than other groups. When the facilitator paired small groups into larger groups, she matched groups that had highly active participants with other groups that also had active participants. If she had organized the groups differently, that is, active with inactive participants, the synergism may have raised the overall level of engagement in the activities. In sum, ACME facilitators could find other strategies for communicating the expectation that teachers will engage in activities within the session.

Other ACME Professional Development

Two professional development formats, campus support and teacher cadre, were offered to a small proportion of AISD teachers. Teachers who participated highly valued these opportunities for professional growth.

Campus Support

One ACME professional development experience that teachers raved about was campus support. In the case study of nine AISD schools (Batchelder & Christian, 1999), many teachers at pilot schools where ACME facilitators provided campus support said they appreciated the help they received from support on campus. Teachers could call with a question about the curriculum or ask to be observed. One teacher at a pilot school praised campus support and said, "They've done a very good job, they've…tried to help us iron out problems."

At another pilot school, the entire fourth grade team of teachers wrote and signed an open letter "to express their appreciation and professional regard for the services and leadership provided by" an ACME facilitator who provided support on their campus:

> *We have enjoyed her perspective, depth of knowledge, honesty, and sense of humor. She has always been available to assist or find help, when requested, offered direction and suggestion, as well as guided us in preparation for using "Investigations" in our classes and TAAS [Texas Academic Assessment Test] testing…. Because of her sensitivity, we feel we've been listened to and respected as professionals. We look forward to her continued mentorship of us as we explore new math horizons with our students.*

In this letter, the teachers asserted their appreciation for the one-on-one mentoring they received in mathematics instruction from on campus support. These words indicate that as a team they formed collegial relationships with the ACME facilitator and benefited from her expertise in mathematics and professional direction.

It is important to note that teachers seem to appreciate campus support in part because it may pull them out of the isolation of classroom teaching. However, as the case study of nine schools demonstrated, pilot schools, which received campus support from ACME staff, were not further along in implementation than were other schools; teachers displayed a range of

competence in standards-based instruction at all schools observed (Batchelder & Christian, 1999). Perhaps, teachers with expertise in standards-based mathematics on campuses could provide leadership and mentor their colleagues in reflective practice to improve instruction optimally.

Teacher Cadre Professional Development

As previously described (see "ACME Professional Development Facilitators, Five Categories of Facilitators"), teacher cadre meetings provided advanced professional development to some teachers who were skilled in standards-based mathematics instruction. One teacher whose passion was standards-based mathematics stated that the teacher cadre meetings were "terrific." She considered the meetings to be the most helpful aspect of ACME professional development, and said:

> *It offers ways to get in depth, hear different points of view and perspectives.... It brings you back to class rejuvenated. It's given me other ideas and ways to talk about things. It's O.K. Other teachers have the same concerns and successes, there's commonality; you're not alone.... There's support there, you're more able to take risks, when you've got people behind you.*

The meetings were a venue where skilled teachers could meet and form professional relationships with other teachers with similar competence in standards-based mathematics instruction.

Shortcoming of Other ACME Professional Development

One shortcoming of campus support and teacher cadre professional development merits consideration. Both of these alternative forms of professional development touch a small number of teachers. In the second year of the ACME project, only eight pilot elementary schools received campus support, and only 30 teachers were members of the teacher cadre. Although the ACME team did not have the staff resources to develop relationships with every elementary and middle school campus in the district, the district did. As the case study of nine schools revealed, teachers' expertise in standards-based mathematics instruction is typically underutilized on campuses (Batchelder & Christian, 1999). Campus administrators and teachers themselves could organize campus mentorships to help less skilled teachers build their capacity through the use of experts on campus.

Effects on Teachers' Knowledge and Skills

Classroom Observations of Mathematics Instruction

Definition of Rating Scale

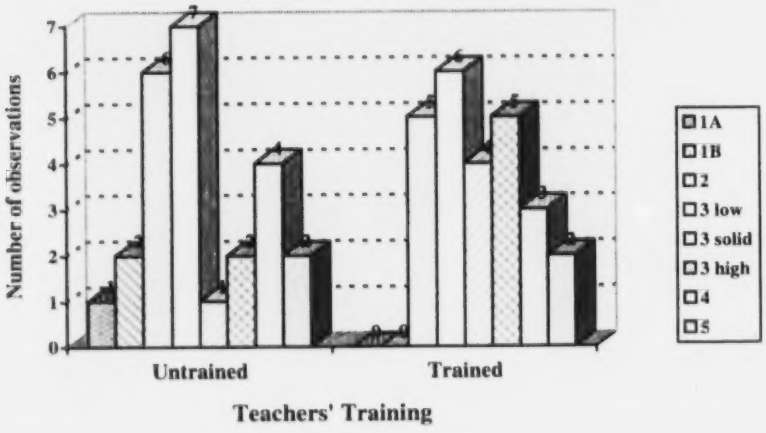
Mathematics lessons were rated using the Classroom Observation Protocol (HRI, 1999b) on an 8-point scale ranging from *ineffective* to *effective* standards-based instruction. Level 1 refers to *ineffective instruction* in which there is little evidence of student engagement with mathematical ideas. Level 1 has two subcategories: Level 1A involves passive learning in which the students receive knowledge from the teacher or text and Level 1B is activity for activity's sake in which hands-on lessons lack purpose or content. Level 2 describes *instruction with elements of effectiveness* that has substantial problems in the design, implementation or content of the lesson, and is limited in the likelihood to enhance children's mathematical knowledge. Level 3 refers to *beginning stages of effective instruction* characterized by a few elements of effectiveness that frequently engage children in mathematical concepts, but has some

weaknesses. Level 3 is divided into three ordinal subcategories of low, solid, and high. Level 4 reflects *effective instruction* that is engaging for most students, whereas level 5 describes *exemplary instruction* that engages all of the students most of the time and represents the art more than the craft of teaching.

Classroom Observations of Trained and Untrained Teachers

Figure 1 presents frequency distributions of the 50 classroom observation ratings for trained (i.e., 20 hours or more of ACME professional development) and untrained (i.e., less than 20 hours of ACME professional development) teachers. The frequencies indicated that ACME professional development was related to a high number of lessons rated effective. The lessons of 15 trained teachers were rated as beginning stages of effective instruction at levels 3 low, solid, and high, whereas the lessons of 10 untrained teachers were rated level 3. Additionally, the lessons of no trained teachers were rated as ineffective instruction at levels 1A or 1B, but the lessons of three untrained teachers were rated levels 1A or 1B. About the same number of trained and untrained teachers were rated at levels 4 and 5.

Figure 1. Frequency Distributions of Classroom Observation Ratings by Teachers' Training in 1999



Examination of the histogram reveals that the distribution of the ratings of the lessons of untrained teachers was bimodal centered around levels 2 to 3 low and level 4 and was more variable than the distribution of ratings of the lessons of trained teachers. A test of homogeneity of variance was not significant (Levene's statistic (SD_1 =1.95, SD_2 =1.59) = .85), which attests to the differences in the variability of these two distributions. Thus, participation in ACME professional development made the instruction of teachers similar and concentrated at the different subcategories of level 3 (i.e., low, solid, and high).

Examination of the central tendency of the two groups revealed a trend for the rating of the lessons of trained teachers (mean rank = 27.74) to be higher than the rating of the lessons of untrained teachers (mean rank = 22.15, Mann-Whitney U = 231.5, $p < .10$). Thus, ACME professional development tends to influence inquiry-based instruction among AISD mathematics teachers that is more effective than the instruction of teachers who do not participate.

However, the number of hours that teachers had participated in ACME professional development was not correlated with the rating of their lessons on this 8-point scale. This

finding may be due to the fact that teachers begin ACME professional development with different skill levels in standards-based mathematics instruction. The eight untrained teachers whose lessons were rated at level 3 high or above suggests that a number of teachers who have not participated in ACME professional development have those skills, which are goals of the ACME project. This finding suggests that the district has a pool of resources to support standards-based mathematics education that may not be fully tapped.

Insights from Observers

The certified evaluators outlined several insights about standards-based instruction on AISD campuses from observing the lessons. Mathematics content knowledge was a key factor that distinguished between a lesson that lacked effectiveness (i.e., levels 2 or 3 low) and one that did not (level 3 high or above). If teachers had limited content knowledge, they were unable to explore the mathematics of the lesson deeply, sometimes confused students, and missed opportunities to help children expand their understandings. Classroom culture also distinguished between effective and ineffective lessons. In these lessons, teachers were uncomfortable with standards-based pedagogy, presented teacher-driven lessons, and cut off student exploration of the mathematical concepts.

The characteristics of lessons that were rated accomplished or exemplary instruction (i.e., levels 4 and 5) centered on knowledge and skills in standards-based pedagogy as well as refined classroom culture with deep exploration of mathematical concepts. These teachers were facile with the mathematical content knowledge and asked students probing questions. These educators got involved in the learning of almost every child in the classroom, and most children seemed to move from one level of understanding to another. These teachers appeared to have positive regard for all of the students in the classroom and high expectations that the students would understand the mathematics behind the lesson.

Deepening Teachers' Understanding of Mathematics Content

Activities for Adult Learners

One of the main concerns of the ACME team at the end of the baseline year was how to help teachers gain mathematics content knowledge through ACME professional development. In the summer institutes of 1999, the ACME team presented teachers with engaging problems to solve that would allow them to deeply explore mathematical concepts and reflect on their experiences as learners. The ACME facilitators designed activities that, as one team member said, would "put teachers in math situations and make them push it further." For example, ACME facilitators asked second and third grade teachers in small groups to skip count by 21s, to predict what number would be at the end by looking for patterns, and ultimately to write an algebra statement. Thus, by designing activities in which teachers explore mathematics at levels higher than they teach, the ACME team helped teachers deepen their mathematics content knowledge. Rather than lecturing about mathematics content, the ACME team applied constructivist principles in their work by helping teachers learn mathematics content through inquiry.

The ACME team also helped teachers deepen their mathematics content knowledge by examining children's mathematical thinking and problem solving. They had teachers develop their own computational strategies because many learned to solve mathematics problems by following the steps of algorithms. These exercises allowed teachers to look at mathematical concepts as their students might. In other activities, teachers analyzed mathematical concepts in

student work, which allowed educators to apply and develop their understanding of mathematics. For example, the participants examined student work and developed assessment strategies that would ensure interrater reliability. Additionally, the ACME team designed activities in which teachers explored mathematics content knowledge through infusion. The ACME facilitators engaged teachers in activities that addressed computation, measurement, algebra, geometry and other topics as they became familiar with the instructional materials.

No inaccuracies in the presentation of mathematics content were observed during professional development activities. Among teachers who were engaged in ACME professional development activities, many applied themselves and struggled with mathematics topics of which they did not have a complex understanding.

Mathematics Content Knowledge Gained

Although the ACME team tailored professional development activities to the needs of adult learners, the approach to teachers' mathematics content knowledge may have a smaller impact than to other areas of standards-based instruction. Teachers who were asked about the impact of ACME professional development on their teaching rarely talked about mathematics content knowledge, even when explicitly asked about content. It is as if they did not have the words to describe the mathematical concepts underlying the curriculum resources. When asked about changes in the mathematics content of his teaching, one educator stated, "It's hard to say.... I haven't thought of activities outside the box." Another teacher when asked about content referred to changes in her pedagogy; rather than teaching children basic math facts, she said that "[*Investigations*] has moved me more towards problem-solving and everyday math." It may be that the lack of commentary on mathematics content reflects the fact that the random sample of interviews included only elementary teachers, who typically do not have a background in mathematics. Middle school teachers, in contrast, who specialize in specific content areas, were observed discussing complex mathematical concepts (see previous discussion in "Teachers' Experiences in ACME Professional Development").

Of the teachers surveyed who had participated in ACME professional development, 39% reported that their participation increased their mathematics content knowledge "somewhat" or "to a great extent," whereas 44% reported that participation in ACME increased their understanding of how children think about/learn mathematics and 51% reported that participation increased their ability to implement high quality mathematics instructional materials. Similarly, among teachers surveyed in 1999, there was a trend for more teachers to report feeling more prepared to teach different areas of mathematics content (e.g., measurement, algebra, and geometry) than in the previous year, but the results for increases in pedagogy were more powerful.

The ACME project has not established a means for evaluating the depth of mathematics content knowledge that teachers gain through ACME professional development. The ACME facilitators themselves expressed uncertainty about how well teachers learned mathematics content. One facilitator said that in conducting five weeks of summer institutes she observed a few "Ah-has" per week from teachers about content in the large group (although this measure does not document realizations that teachers keep to themselves). Another facilitator stated that she found out about teachers' understanding of mathematics content through conversations with teachers about 'what kids understand.' This facilitator stated that often she did not hear much beyond awareness of content; deep conceptual understanding was rare. Thus, the ACME team

has observed some improvements in teachers' mathematics content knowledge, although these gains may not be deep or pervasive districtwide.

Evidence from classroom observations suggests that trained teachers who participated in 20 hours or more of ACME professional development become more effective in standards-based instruction of which mathematics content is a part. Although many teachers presented the content of *Investigations* and *CMP* lessons accurately, some trained teachers were observed mixing up the concepts of surface area and volume and confusing her students. Other teachers treated content at a superficial level or misinterpreted students' questions because the educators lacked content knowledge. Assessment of the mathematics content knowledge that teachers gain in ACME professional development may suggest improvements to make in activities.

Improving Teachers' Knowledge of Pedagogy

Conversations about Pedagogy and Student Work

One area of standards-based instruction that the ACME team tackled and improved in the past year was pedagogy and helping teachers to develop an understanding of students' mathematical thinking. The team attacked these teaching strategies from several different angles. As facilitators, they modeled pedagogy and asked teachers questions such as "How did I facilitate this activity to help you understand the mathematics?" Although in the previous summer the team had included pieces on open-ended questioning strategies, in the Summer of 1999 facilitators raised the bar and stimulated professional conversations about these strategies through a book study of *Beyond Arithmetic* (1995) and examining Bloom's taxonomy as related to the state standards TEKS. Additionally, the ACME team made videos of AISD teachers skilled in standards-based pedagogy, screened the videos in ACME professional development, and held group discussions of the observed teaching strategies and students' dialogue. ACME facilitators also had teachers share their own experiences in class as well as predict what students might do if they posed questions one way rather than another.

By honing their approach to assessment strategies, the ACME team helped teachers improve their understanding of student's mathematical thinking. The ACME team members designed a professional development piece to promote better reliability across teachers on the district's performance assessment program. They focused on rating student work with rubrics on a developmental continuum of low, medium, and high and on the dimensions of mathematical thinking, communicating support for thinking, and mathematical skills. By examining teachers' rating from previous ACME professional development, they noted a misunderstanding: Teachers considered students' different *representations* of solutions as distinct *strategies* when actually children had presented just one strategy in several different ways. In ACME summer institutes, teachers learned to rate student work and participated in professional conversations about student mathematical understanding. In follow-up professional development during the academic year, teachers will bring their samples of student assessments and continue working on applying rubrics and developing.

In ACME professional development, ACME facilitators explored with teachers the needs of diverse learners by discussing extensions and adaptations to activities. At teachers' requests, the ACME team developed the planning tool of charts with extensions for gifted and talented, special education, and bilingual/ESL students. These charts covered every investigation of every book of *Investigations* and *CMP*.

Teachers' Knowledge of Standards-Based Pedagogy Gained

The ACME team appears to have had an impact on some teachers' knowledge of standards-based pedagogy. Teachers surveyed in the Spring of 1999 reported significantly higher levels of preparation to implement standards-based instructional strategies (e.g., have students participate in hands-on activities and work in cooperative groups) than did teachers in the previous year. Additionally, significantly more teachers surveyed reported that they used standards-based instructional strategies more often than did the previous year. However, these increases are based on teachers' self-reports and were not confirmed by observation.

The impact that the ACME project had on teachers' knowledge of standards-based pedagogy also emerged in how they talked about changes in their pedagogy. Their words echoed the emphasis that the ACME team placed on solving problems with multiple strategies. One teacher said that standards-based instruction "allows for children to explain their thinking processes; it made me aware of how divergent different children's thinking processes are." Another teacher said that the most helpful aspect was that standards-based curriculum allowed "students to develop their own strategies and share them with others; there's not just one way of doing a problem." Another teacher noted the importance of questioning, and said that her teaching strategies in mathematics included "more problem-solving, inquiry; math is learning from questions." One teacher stated that standards-based pedagogy helps reach diverse learners; "It's shown me that there is a way to reach all children, irregardless of their level, with hands on, it reinforces my idealism that all children can learn."

Skills in Standards-Based Pedagogy in Classrooms

Although ACME professional development provided opportunities for teachers to acquire knowledge of standards-based pedagogy, the activities are one step removed from what the initiative attempts to change, that is, what teachers do in classrooms. Classroom observations indicated that ACME professional development influenced change in instruction such that more trained teachers demonstrated effective instruction than untrained teachers. However, in the case study of nine schools, teachers demonstrated a range of skills in standards-based instruction (Batchelder & Christian, 1999). The finding that teachers were able to articulate principles of standards-based pedagogy does not necessarily imply that this knowledge transfers to pedagogical skills in the classroom. With campus resources such as experts in standards-based instruction, direct observation and feedback may help teachers apply this knowledge and hone their skills in standards-based pedagogy in their classrooms.

Learning How to Use the Instructional Materials

Availability of Materials

When the ACME project began, all teachers received a set of the *Investigations* and *CMP* curriculum resources and schools received one kit of manipulatives for every two teachers. In response to teachers' requests for their own set of manipulatives, the AISD Mathematics Department applied for and the AISD board of trustees approved funds for one kit per mathematics teacher in the 1999-2000 academic year. Also, in response to teachers' needs, the board approved funds for copies of student sheets for every teacher's class because educators had spent too much time making copies.

Approaches to Instructional Materials in ACME Professional Development

To help teachers become comfortable with and learn how to implement standards-based instructional materials, several different approaches have evolved. In the first year of the ACME

project, ACME team members designed a scavenger hunt to help teachers learn the components of the resources. The team has continued to launch ACME professional development for first-time participants this way. Throughout ACME professional development, participants were asked to engage in activities that exposed them to manipulatives, to play the games in the resources, and to explore the mathematics underlying the activities. In follow-up sessions, professional development activities focused on books that teachers were scheduled to use in the coming months. In these professional development pieces, ACME facilitators encouraged participants to discuss the materials one-on-one, in small groups, and in large groups, and to share experiences from their classrooms. These discussions included how to organize materials and classroom management. Most recently, the ACME team modified summer institutes by bringing in classroom teachers from the teacher cadre who were proficient in standards-based pedagogy to model lessons from *Investigations*. An observation of one of these sessions was convincing because the teacher was able to draw on her recent experiences using the materials in her classroom and describe what worked and what did not.

Teachers' Knowledge and Implementation of the Instructional Materials

Most of what teachers appreciated about ACME professional development were the instructional materials and support for learning how to use them. Some teachers appeared to have a thorough knowledge of the contents of the materials. One teacher said, "I love the *Investigations* books, the layout, the different investigation materials needed, the teacher notes, the problems kids encounter, ways to reach kids, the activities, and manipulatives." Another teacher appreciated the organization of the books, and said, "How it has been set up--ordering of how to teach in the books, letters for parents, assignments, student worksheets; there's an order to it; versatility, it allows me to add things that I think my students need." Other teachers did not appreciate the organization or the content of the materials. One teacher said, "Some of the choice times, some in different books don't seem to be meaningful at all; they're repetitive."

In general, AISD teachers who participated in ACME professional development became more comfortable with the instructional materials as they progressed through the program. In classroom observations, some teachers, especially those who had participated in two years of ACME professional development, appeared to be comfortable with the materials and demonstrate some effectiveness in their instruction. Other teachers, particularly those in their first year of implementation, appeared shaky and uncomfortable with the materials, sometimes reading from the book.

Implementation of ACME Professional Development

The ACME professional development model is grade-by-grade implementation for all AISD elementary and middle schools. Eight pilot elementary schools implemented the ACME project such that teachers at all grade levels participated in professional development simultaneously. The implementation of the design of the ACME project is on schedule: Most fifth and sixth grade teachers completed ACME professional development in the Spring of 1999, most fourth and seventh grade teachers completed it in the Spring of 2000, and most second, third, and eighth grade teachers completed it in the Spring of 2001. Kindergarten and first grade teachers will attend their first institute in the summer of 2000 and complete two years of professional development in the 2001-2002 academic year.

Attendance at initial and follow-up institutes in the summer of 1999, however, was less than 100%. In AISD, each elementary grade level had approximately 250 teachers and each

middle school grade level had approximately 60 mathematics teachers. Approximately 20% of AISD elementary schools departmentalize subjects in the fourth and/or fifth grades so that half of the teachers in those schools do not teach mathematics. The attendance at the summer institutes of 1999 for second and third grade teachers was comparable to the attendance fourth grade teachers the previous summer; approximately 90% of the teachers who were expected to attended the first week of the 1999 summer institute and approximately 75% attended the second week (Batchelder, 1998). Similarly, 80% of eighth grade teachers attended the first summer institute of ACME professional development in 1999. As for fifth grade teachers in the previous year, attendance at follow-up summer institutes for fourth, sixth, and seventh grade teachers tapered off to about 60% of the expected attendance.

On the basis of attendance, it appears that for the past two years not all teachers targeted were participating in ACME professional development. By the end of the summer of 1998, ACME staff figured out that many new teachers were hired before school started and after ACME summer institutes ended. As a result, they were unable to attend summer institutes until after they started teaching. The ACME team lead reported that high turnover in the district amounted each year to about 60 new hires at the elementary level and about 20 new hires at the middle school level. In addition, ACME staff noted that some teachers changed grade level positions often from one year to the next. In response to this transience, ACME staff decided to repeat summer institutes for grade levels for which the cycle through two years of ACME professional development had already been started or was complete. They also held brief one-day overviews about standards-based mathematics in the first month of school. Some established AISD teachers who had skipped the summer institute that they were targeted to attend also participated in the repeated summer institutes. For fourth, sixth, and seventh grade teachers, attendance at repeated institutes in 1999 was relatively high at 63% to 80% of the expected 60 participants, but not for fifth grade teachers at 45% of the expected number.

SUMMARY AND RECOMMENDATIONS

STRENGTHS OF ACME PROFESSIONAL DEVELOPMENT

- One key strength of ACME professional development is how the core ACME team members work together and their vision of high quality standards-based professional development. The incorporation of constructivist principles such as collaborating, bridging on the expertise of others, and pursuing professional growth solidifies continuous improvements in the quality of their work.
- The abundance of collegial and financial resources provides invaluable support to the ACME team.
- The strong ACME team leadership pushes the team members to improve their work by analyzing available information about problems and finding workable solutions.
- The ACME facilitators make themselves vulnerable and listen to the needs of teachers. Many changes in the design of the ACME project that cater to teachers' needs have come from this openness.
- ACME professional development provides many rich opportunities to explore standards-based curriculum resources and instructional strategies for those teachers who actively engage in activities.

CHALLENGES OF ACME PROFESSIONAL DEVELOPMENT

- The ACME team needs to find ways to improve teachers' participation within professional development sessions.
- Although the ACME team has learned to listen to teachers comments rather than dismiss them, one challenge is to figure out what merits attention and what does not.
- Another challenge is to make campus support meaningful, not superficial, such that it will support teachers in reflective practice and push their pedagogical skills to levels that promote the mathematical understanding of diverse learners.
- The district needs to make full use of resources on campuses. Although the ACME project promotes standards-based curriculum resources and instruction, underutilized expertise on campuses is a resource that has the potential to influence improvements in mathematics education but is presently falling through the cracks. Ensuring that teacher leadership and mentorship in standards-based mathematics is a central part of other district initiatives such as Account for Learning is imperative to institutionalize reforms.
- The ACME team needs to find ways of ensuring that teachers who lack mathematics content knowledge learn more.
- Although teachers seem to be building their capacity to communicate principles of standards-based pedagogy, putting this knowledge into practice is one step removed from most professional development activities. The addition of peer coaching to the ACME project's repertoire of professional development begins to tackle the need for observation and feedback to help teachers improve their pedagogical skills in the classroom.

RECOMMENDATIONS

ACME Professional Development Facilitators

- Continue to develop team support through collaboration and the drive to improve the work of ACME.
- Continue to enlist the support of campus administrators for standards-based mathematics education.
- Continue to address teachers' needs through responsiveness, but evaluate priorities.

Teachers' Experiences in ACME Professional Development

- Continue to provide high quality professional development in which teachers have opportunities to share with colleagues and experts in standards-based mathematics education.
- Address inactivity among teachers within professional development sessions by asking engaging questions that promote participation.
- Continue to develop strategies of campus support that promote meaningful discussions and reflection about standards-based pedagogy that will help teachers improve instruction.

Improving teachers' knowledge and skills in standards-based mathematics:

- Focus on helping teachers learn more mathematics content knowledge; determine standards with which teachers are uncomfortable, set goals for tackling those concepts in professional development, and assess how well those goals were met.
- Continue to help teachers gain standards-based pedagogical knowledge; set up peer coaching networks on campuses to provide teachers observation and feedback on their instructional strategies.
- Continue to actively engage teachers with instructional materials and to have classroom teachers model lessons.

Sustaining Professional Development in Standards-Based Mathematics

- Establish summer institutes, follow-up during the academic year, and overviews for new hires at all grade levels that will continue after the NSF grant ends.

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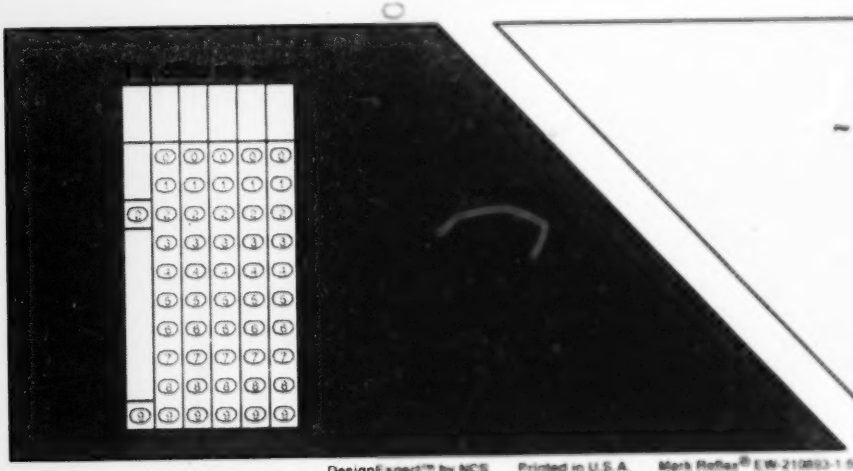
APPENDICES

Form Approval OMB No. 3145-0136 Expires: August 2001

Local Systemic Change *through* Teacher Enhancement

1999 Teacher Questionnaire

Mathematics (Grades K-8)



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Horizon Research, Inc.

National Science Foundation

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Instructions: Please use a #2 pencil to complete this questionnaire. Darken ovals completely, but do not stray into adjacent ovals. Be sure to erase completely any stray marks.

A. Teacher Demographic Information

1. Are you:

- ○ Male
- ○ Female

2a. Ethnicity - Are you: (Darken one oval.)

- ○ Hispanic or Latino
- ○ Not Hispanic or Latino

2b. Race - Are you: (Choose one or more.)

- ○ American Indian or Alaskan Native
- ○ Asian
- ○ Black or African-American
- ○ Native Hawaiian or Other Pacific Islander
- ○ White

3. How many college mathematics courses have you completed? (Darken one oval.)

- ○ None
- ○ 1 semester
- ○ 2 semesters
- ○ 3 semesters
- ○ 4 semesters
- ○ 5 or more semesters

4. Did your college mathematics coursework include the equivalent of at least one semester of: (Darken one oval on each line.)

		Yes	No
a.	Number system concepts	○	○
b.	Concepts in algebra	○	○
c.	Concepts in geometry	○	○

5. How many years have you taught prior to this school year? (Darken one oval.)

0-2	3-5	6-10	11-15	16-20	21-25	26 or more
○	○	○	○	○	○	○

The National Science Foundation's Local Systemic Change (LSC) through Teacher Enhancement Program's Core Evaluation

You have been selected to participate in the nationwide evaluation of the federally-funded Local Systemic Change (LSC) program. LSC is a National Science Foundation Teacher Enhancement program that is currently funding more than 60 local projects that offer science and mathematics professional development to teachers in 26 states around the country. **The cover letter accompanying this questionnaire identifies the LSC project in your area, as well as the instructional materials that are the focus of that LSC project.**

Each LSC project will administer questionnaires each spring to a randomly-selected sample of teachers who are targeted to participate in the local project's professional development activities. Note that you may be asked to complete this questionnaire even if you have not yet participated in the project's professional development; your response is important, regardless of whether you have already participated. A small number of randomly-selected teachers in each project is asked to provide additional information in interviews, sometimes in conjunction with a classroom visit. In order to continue receiving federal funding, each LSC project must participate in this national evaluation.

Data collection procedures have been developed to ensure high-quality data and protect teacher confidentiality. Your responses will be kept strictly confidential; they will be combined with the responses of the other teachers in your project and used only for the LSC evaluation. The name label and numbering on this questionnaire are used to help local projects deliver questionnaires to the proper teachers and follow up with teachers who have not responded; no information identifying individual teachers will be reported under any circumstances. After you complete the questionnaire, you should remove the name label and return the questionnaire as specified by your local LSC project. Additional information about privacy, as well as public burden, is provided on page 7 of this questionnaire.

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B. Teacher Opinions and Preparedness

6. Please provide your opinion about each of the following statements. (Darken one oval on each line.)

	Strongly Disagree	Disagree	No Opinion	Agree	Strongly Agree
a. Students generally learn mathematics best in classes with students of similar abilities.	○	○	○	○	○
b. I feel supported by colleagues to try out new ideas in teaching mathematics.	○	○	○	○	○
c. Teachers in this school have a shared vision of effective mathematics instruction.	○	○	○	○	○
d. Teachers in this school regularly share ideas and materials related to mathematics.	○	○	○	○	○
e. Teachers in this school are well-supplied with materials for investigative mathematics instruction.	○	○	○	○	○
f. I have time during the regular school week to work with my peers on mathematics curriculum and instruction.	○	○	○	○	○
g. I have adequate access to calculators for teaching mathematics.	○	○	○	○	○
h. I have adequate access to computers for teaching mathematics.	○	○	○	○	○
i. I enjoy teaching mathematics.	○	○	○	○	○
j. I am well-informed about the NCTM *Standards* for the grades I teach.	○	○	○	○	○
k. The mathematics program in this school is strongly supported by local organizations, institutions, and/or businesses.	○	○	○	○	○

7. In the left section, please rate each of the following in terms of its **importance** for effective mathematics instruction in the grades you teach. In the right section, please indicate how **prepared** you feel to do each one. (Darken one oval in each section on each line.)

	Importance				**Preparation**			
	Not Important	Somewhat Important	Fairly Important	Very Important	Not Adequately Prepared	Somewhat Prepared	Fairly Well Prepared	Very Well Prepared
a. Provide concrete experience before abstract concepts.	○	○	○	○	○	○	○	○
b. Develop students' conceptual understanding of mathematics.	○	○	○	○	○	○	○	○
c. Take students' prior understanding into account when planning curriculum and instruction.	○	○	○	○	○	○	○	○
d. Practice computational skills and algorithms.	○	○	○	○	○	○	○	○
e. Make connections between mathematics and other disciplines.	○	○	○	○	○	○	○	○
f. Have students work in cooperative learning groups.	○	○	○	○	○	○	○	○
g. Have students participate in appropriate hands-on activities.	○	○	○	○	○	○	○	○
h. Engage students in inquiry-oriented activities.	○	○	○	○	○	○	○	○
i. Use calculators.	○	○	○	○	○	○	○	○
j. Use computers.	○	○	○	○	○	○	○	○
k. Engage students in applications of mathematics in a variety of contexts.	○	○	○	○	○	○	○	○
l. Use performance-based assessment.	○	○	○	○	○	○	○	○
m. Use portfolios.	○	○	○	○	○	○	○	○
n. Use informal questioning to assess student understanding.	○	○	○	○	○	○	○	○

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8. My principal: (Darken one oval on each line.)

	Strongly Disagree	Disagree	No Opinion	Agree	Strongly Agree
a. Encourages me to select mathematics content and instructional strategies that address individual students' learning.	○	○	○	○	○
b. Accepts the noise that comes with an active classroom.	○	○	○	○	○
c. Encourages the implementation of current national standards in mathematics education.	○	○	○	○	○
d. Encourages innovative instructional practices.	○	○	○	○	○
e. Enhances the mathematics program by providing me with needed materials and equipment.	○	○	○	○	○
f. Provides time for teachers to meet and share ideas with one another.	○	○	○	○	○
g. Encourages me to observe exemplary mathematics teachers.	○	○	○	○	○
h. Encourages teachers to make connections across disciplines.	○	○	○	○	○
i. Acts as a buffer between teachers and external pressures (e.g., parents).	○	○	○	○	○

9. Many teachers feel better prepared to teach some subject areas than others. How well prepared do you feel to teach each of the following subjects at the grade levels you teach, whether or not they are currently included in your curriculum? (Darken one oval on each line.)

	Not Adequately Prepared	Somewhat Prepared	Fairly Well Prepared	Very Well Prepared
a. Science	○	○	○	○
b. Mathematics	○	○	○	○
c. Reading/Language Arts	○	○	○	○
d. Social Studies	○	○	○	○

10. Within mathematics, many teachers feel better prepared to teach some topics than others. How well prepared do you feel to teach each of the following topics at the grade levels you teach, whether or not they are currently included in your curriculum? (Darken one oval on each line.)

	Not Adequately Prepared	Somewhat Prepared	Fairly Well Prepared	Very Well Prepared
a. Numeration and number theory	○	○	○	○
b. Computation	○	○	○	○
c. Estimation	○	○	○	○
d. Measurement	○	○	○	○
e. Pre-algebra	○	○	○	○
f. Algebra	○	○	○	○
g. Patterns and relationships	○	○	○	○
h. Geometry and spatial sense	○	○	○	○
i. Data collection and analysis	○	○	○	○
j. Probability	○	○	○	○
k. Technology (calculators, computers) in support of mathematics	○	○	○	○

11. Within the arena of mathematical processes, many teachers feel better prepared to guide and help develop student learning in some domains than others. How well prepared do you feel to provide guidance in the following, at the grade levels you teach? (Darken one oval on each line.)

	Not Adequately Prepared	Somewhat Prepared	Fairly Well Prepared	Very Well Prepared
a. Problem solving	○	○	○	○
b. Reasoning and proof	○	○	○	○
c. Communication (written and oral)	○	○	○	○
d. Connections within mathematics and from mathematics to other disciplines	○	○	○	○
e. Multiple representations (e.g., concrete models, and numeric, graphical, symbolic, and geometric representations)	○	○	○	○

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12. Please indicate how well prepared you feel to do each of the following. (Darken one oval on each line.)

	Not Adequately Prepared	Somewhat Prepared	Fairly Well Prepared	Very Well Prepared
a. Lead a class of students using investigative strategies.	①	②	③	④
b. Manage a class of students engaged in hands-on/project-based work.	①	②	③	④
c. Help students take responsibility for their own learning.	①	②	③	④
d. Recognize and respond to student diversity.	①	②	③	④
e. Encourage students' interest in mathematics.	①	②	③	④
f. Use strategies that specifically encourage participation of females and minorities in mathematics.	①	②	③	④
g. Involve parents in the mathematics education of their students.	①	②	③	④

13. Please rate the effect of each of the following on your mathematics instruction. (Darken one oval on each line.)

	Inhibits effective instruction		Neutral or mixed		Encourages effective instruction	N/A / Don't Know
a. State and/or district curriculum frameworks.	①	②	③	④	⑤	NA
b. State and/or district testing policies and practices.	①	②	③	④	⑤	NA
c. Quality of available instructional materials.	①	②	③	④	⑤	NA
d. Access to calculators for mathematics instruction.	①	②	③	④	⑤	NA
e. Access to computers for mathematics instruction.	①	②	③	④	⑤	NA
f. Funds for purchasing equipment and supplies for mathematics.	①	②	③	④	⑤	NA
g. System of managing instructional resources at the district or school level.	①	②	③	④	⑤	NA
h. Time available for teachers to plan and prepare lessons.	①	②	③	④	⑤	NA
i. Time available for teachers to work with other teachers.	①	②	③	④	⑤	NA
j. Time available for teacher professional development.	①	②	③	④	⑤	NA
k. Importance that the school places on mathematics.	①	②	③	④	⑤	NA
l. Consistency of mathematics reform efforts with other school/district reforms.	①	②	③	④	⑤	NA
m. Public attitudes toward reform.	①	②	③	④	⑤	NA

14. How many of your students' parents do each of the following? (Darken one oval on each line.)

	None	A Few		About 1/2		Almost All
a. Volunteer to assist with class activities.	⓪	①	②	③	④	⑤
b. Donate money or materials for classroom instruction.	⓪	①	②	③	④	⑤
c. Attend parent-teacher conferences.	⓪	①	②	③	④	⑤
d. Attend school activities such as PTA meetings and Family Mathematics nights.	⓪	①	②	③	④	⑤
e. Voice support for the use of an investigative approach to mathematics instruction.	⓪	①	②	③	④	⑤
f. Voice support for traditional approaches to mathematics instruction.	⓪	①	②	③	④	⑤

C. Your Mathematics Teaching

Questions 15-21 ask about your mathematics teaching. Please answer for your first elementary/middle school mathematics class of the day.

15. What grade level is this class? (Darken all ovals that apply.)

K	1	2	3	4	5	6	7	8
○	○	○	○	○	○	○	○	○

16. Do you teach in a self-contained classroom (i.e., you are responsible for teaching several subjects to one class)? (Darken one oval.)

○ Yes ○ No **(Skip to Question 20)**

17. How many lessons per week do you typically teach mathematics to this class? (Darken one oval.)

Number of Lessons

0	1	2	3	4	5
○	○	○	○	○	○

18. Approximately how many minutes is a typical mathematics lesson? (Darken one oval.)

Average Number of Minutes per Lesson

10 or less	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81 or more
○	○	○	○	○	○	○	○	○

19. In how many of the last five school days did you teach each of the following in this class? (Darken one oval on each line.)

	Number of Days					
	None	One	Two	Three	Four	Five
a. Science	○	○	○	○	○	○
b. Mathematics	○	○	○	○	○	○
c. Reading/Language Arts	○	○	○	○	○	○
d. Social Studies	○	○	○	○	○	○

20. About how often do **you** do each of the following in your mathematics instruction in this class? (Darken one oval on each line.)

	Never	Rarely (e.g., a few times a year)	Sometimes (e.g., once or twice a month)	Often (e.g., once or twice a week)	All or almost all mathematics lessons
a. Use the LSC-designated instructional materials (see cover letter) as the basis of mathematics lessons.	①	②	③	④	⑤
b. Introduce content through formal presentations.	①	②	③	④	⑤
c. Arrange seating to facilitate student discussion.	①	②	③	④	⑤
d. Use open-ended questions.	①	②	③	④	⑤
e. Require students to explain their reasoning when giving an answer.	①	②	③	④	⑤
f. Encourage students to communicate mathematically.	①	②	③	④	⑤
g. Encourage students to explore alternative methods for solutions.	①	②	③	④	⑤
h. Encourage students to use multiple representations (e.g., numeric, graphic, geometric, etc.).	①	②	③	④	⑤
i. Allow students to work at their own pace.	①	②	③	④	⑤
j. Help students see connections between mathematics and other disciplines.	①	②	③	④	⑤
k. Use assessment to find out what students know before or during a unit.	①	②	③	④	⑤
l. Embed assessment in regular class activities.	①	②	③	④	⑤
m. Assign mathematics homework.	①	②	③	④	⑤
n. Read and comment on the reflections students have written in their notebooks or journals.	①	②	③	④	⑤

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21. About how often do **students** in this class take part in each of the following types of activities as part of their mathematics instruction? (Darken one oval on each line.)

	Never	Rarely (e.g., a few times a year)	Sometimes (e.g., once or twice a month)	Often (e.g., once or twice a week)	All or almost all mathematics lessons
a. Participate in student-led discussions.	①	②	③	④	⑤
b. Participate in discussions with the teacher to further mathematical understanding.	①	②	③	④	⑤
c. Work in cooperative learning groups.	①	②	③	④	⑤
d. Make formal presentations to the class.	①	②	③	④	⑤
e. Read from a mathematics textbook in class.	①	②	③	④	⑤
f. Read other (non-textbook) mathematics-related materials in class.	①	②	③	④	⑤
g. Practice routine computations/algorithms.	①	②	③	④	⑤
h. Review homework/worksheet assignments.	①	②	③	④	⑤
i. Use mathematical concepts to interpret and solve word problems.	①	②	③	④	⑤
j. Work on solving a real-world problem.	①	②	③	④	⑤
k. Share ideas or solve problems with each other in small groups.	①	②	③	④	⑤
l. Engage in hands-on mathematical activities.	①	②	③	④	⑤
m. Play mathematics games.	①	②	③	④	⑤
n. Follow specific instructions in an activity or investigation.	①	②	③	④	⑤
o. Design or implement their *own* investigation.	①	②	③	④	⑤
p. Work on models or simulations.	①	②	③	④	⑤
q. Work on extended mathematics investigations or projects (a week or more in duration).	①	②	③	④	⑤
r. Participate in field work.	①	②	③	④	⑤
s. Record, represent and/or analyze data.	①	②	③	④	⑤
t. Write a description of a plan, procedure or problem-solving process.	①	②	③	④	⑤
u. Write reflections in a notebook or journal.	①	②	③	④	⑤
v. Use calculators or computers for learning or practicing skills.	①	②	③	④	⑤
w. Use calculators or computers to develop conceptual understanding.	①	②	③	④	⑤
x. Use calculators or computers as a tool (e.g., spreadsheets, data analysis).	①	②	③	④	⑤
y. Work on portfolios.	①	②	③	④	⑤
z. Take short-answer tests (e.g., multiple choice, true/false, fill-in-the-blank).	①	②	③	④	⑤
aa. Take tests requiring open-ended responses (e.g., descriptions, justifications of solutions).	①	②	③	④	⑤

D. LSC Professional Development

Questions 22-27 refer to the NSF-supported Local Systemic Change (LSC) program. Please refer to the cover letter accompanying this questionnaire for information about the LSC project activities and designated materials in your district.
If you have not yet participated in LSC professional development, darken this ov○ and skip to Question 27.

22. To what extent is each of the following true of LSC mathematics-related professional development in your district? (Darken one oval on each line.)

	Not at all				To a great extent
a. I am involved in planning my mathematics-related professional development.	①	②	③	④	⑤
b. I am encouraged to develop an individual professional development plan to address my needs and interests related to mathematics education.	①	②	③	④	⑤
c. I am given time to work with other teachers as part of my professional development.	①	②	③	④	⑤
d. I am given time to reflect on what I've learned and how to apply it to the classroom.	①	②	③	④	⑤
e. I receive support as I try to implement what I've learned.	①	②	③	④	⑤

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23. Approximately how many ***hours*** have you spent on formal professional development in mathematics/mathematics education as part of the LSC project? (Darken one oval.)

○ 0	○ 10-19	○ 40-59	○ 80-99	○ 130-159	○ 200 or greater
○ 1-9	○ 20-39	○ 60-79	○ 100-129	○ 160-199	

24. Please indicate the number of times you have participated in each of the following activities **during this school year**. (Darken one oval on each line.)

	0	1-2	3-4	5-6	7 or more
A. Formal Activities					
1. Participated in an LSC academic year study group/discussion group	①	②	③	④	⑤
2. Was "coached" on my teaching by an LSC lead teacher/staff person based on a classroom observation	①	②	③	④	⑤
B. Informal Activities					
1. Received assistance from an LSC "lead teacher" in my school	①	②	③	④	⑤
2. Received assistance from an LSC staff person in my district	①	②	③	④	⑤
3. Received assistance from an LSC-designated mathematician/mathematics educator from a college/university/museum/industry	①	②	③	④	⑤
4. Read messages in a Listserv discussion sponsored by the LSC	①	②	③	④	⑤
5. Posted messages to a Listserv discussion sponsored by the LSC	①	②	③	④	⑤

25. How would you rate the overall quality of the LSC professional development? (Darken one oval.)

Very Poor	Poor	Fair	Good	Very Good	Excellent
○	○	○	○	○	○

26. To what extent has participation in LSC mathematics-related professional development increased your: (Darken one oval on each line.)

	Not at all				To a great extent
a. Mathematics content knowledge	①	②	③	④	⑤
b. Understanding of how children think about/learn mathematics	①	②	③	④	⑤
c. Ability to implement high-quality mathematics instructional materials	①	②	③	④	⑤

27. Have you been identified as a lead teacher for your district's NSF-sponsored LSC project? ○ Yes ○ No

Thank you very much for participating in this survey!

Privacy Act and Public Burden Statements The information requested on this survey is solicited under the authority of the National Science Foundation Act of 1950, as amended. The information from this data collection will be retained as part of the Privacy Act System of Records in accordance with the Privacy Act of 1974. Data submitted will be used in accordance with the criteria established by NSF for monitoring research and education grants, and in response to Public Law 99-383 and 24 USC 1885c. The information requested may be disclosed to qualified researchers and contractors in order to coordinate programs and to a Federal agency, court or party in a court or Federal administrative proceeding if the government is a party. Information may be added to and maintained by the Education and Training System of Records 63 Federal Register 264, 272 (January 5, 1998).

Public reporting burden for this collection of information is estimated to average 20 minutes per response, including the time for reviewing instructions. Send comments regarding this burden estimate, or any other aspect of this collection of information, including suggestions for reducing this burden, to Suzanne Plimpton, Reports Clearance Officer, Systems and Services Branch, Division of Administrative Services, National Science Foundation, 4201 Wilson Blvd., Arlington, VA 22230. An agency may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a currently valid OMB control number. The OMB number for this survey is 3145-0136.

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1998–99 Local Systemic Change
Teacher Interview
Middle Years

1. What grade(s) do you teach?

2. This district is involved in an NSF-supported local systemic change initiative.[1]

   To what extent have you participated in those activities (e.g., number of hours/days since becoming involved in the project)?[2]

   PROBE for both summer and academic year activities.

3. How do you feel about the professional development provided by the LSC?

4. How has the LSC affected you and your teaching?

   PROBES: Have there been changes in:
   - the content you teach?
   - the instructional materials you use?
   - the instructional strategies you use?
   - your beliefs or understanding about effective mathematics/science instruction?

   PROBE for examples of changes.

5. What specific characteristics of the LSC have been most helpful to you?

6. What aspects have been least helpful? Why?

7. What else do you need in order to continue improving your mathematics (science) instruction?

---

[1] You may want to use the local name for the LSC instead of, or in addition to, mentioning NSF, perhaps even giving examples of specific activities.

[2] Only treated teachers who have participated in 20 or more hours of professional development have been included in the random sample for teacher interviews.

8. Sometimes school and district policies facilitate reform. At other times they get in the way. Can you give me some examples of areas in which district policies are either supporting the LSC reforms or sending the opposite message? [Make note of which areas were mentioned by the teacher without probing.]

   PROBES: You've mentioned (a couple/a few/several) areas in which you are getting (consistent/mixed) messages. I am going to name some areas that other teachers have mentioned. If you feel any of these have been either particularly supportive or problematic for you, please let me know. [Name only areas not previously mentioned. Be sure to allow wait time after each.]

   a. Curriculum frameworks

   b. Instructional materials and supplies

   c. Student grading or testing policies

   d. Evaluation of teachers

   e. Time to plan, prepare, or work with other teachers outside of time spent at LSC sessions

   f. Other teachers' attitudes toward mathematics (science) education

   g. Principals' attitudes/expectations

   h. Parents' attitudes/expectations

For teachers who have participated in LSC leadership development:
(If teacher has not participated in LSC leadership development, SKIP to Question 10.)

9. To what extent have the professional development activities prepared you for your role as a teacher leader of mathematics (science) reform in your school or district?

10. Do you have any other comments you would like to share?

1999 Local Systemic Change Principal Questionnaire

Form Approval
OMB No: 3145-0136
Expires: August 2001

Instructions: Please use a #2 pencil to complete this questionnaire. Darken ovals completely, but do not stray into adjacent ovals. Be sure to erase completely any stray marks.

A. Mathematics and Science Instruction

1. Please provide your opinion about each of the following statements regarding mathematics and science instruction. (Darken one oval in each section on each line.)

	Mathematics					Science				
	Strongly Disagree	Disagree	No Opinion	Agree	Strongly Agree	Strongly Disagree	Disagree	No Opinion	Agree	Strong Agre
a. Students generally learn best in classes with students of similar abilities.	①	②	③	④	⑤	①	②	③	④	⑤
b. I am knowledgeable about current national standards in this content area.	①	②	③	④	⑤	①	②	③	④	⑤
c. I feel well-prepared to support teachers in the implementation of current national standards.	①	②	③	④	⑤	①	②	③	④	⑤
d. I am willing to accept the noise that comes with an active classroom.	①	②	③	④	⑤	①	②	③	④	⑤
e. Encouraging student questions is more important than eliciting correct answers.	①	②	③	④	⑤	①	②	③	④	⑤

2. Please provide your opinion about each of the following statements. (Darken one oval on each line.)

	Strongly Disagree	Disagree	No Opinion	Agree	Strongly Agree
a. Vocational/technology education should have a strong mathematics and science component.	①	②	③	④	⑤
b. Students who are not interested in science/mathematics/technology careers should be able to opt out of mathematics and science courses after the 10th or 11th grade.	①	②	③	④	⑤
c. Schools need to provide students who are not interested in science/mathematics/technology careers course options in mathematics and science for all of their high school years.	①	②	③	④	⑤
d. Specialized courses in mathematics and science should be available for college-bound students.	①	②	③	④	⑤

3. How would you describe your school's progress in moving toward excellence in mathematics and science education? (Darken one oval on each line.)

	Quite far from ideal		Beginning to improve		Well along in improving		Approaching ideal
a. Mathematics program	①	②	③	④	⑤	⑥	⑦
b. Science program	①	②	③	④	⑤	⑥	⑦

4. Compared to 5 years ago, which best describes the achievement of students in this school? (Darken one oval on each line.)

	Much worse	Somewhat worse	About the same	Somewhat improved	Much improved
a. Mathematics	①	②	③	④	⑤
b. Science	①	②	③	④	⑤

PLEASE DO NOT WRITE IN THIS AREA

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5. Please rate each of the following in terms of its importance for effective mathematics and science instruction. (Darken one oval in each section on each line.)

	Mathematics				Science			
	Not Important	Somewhat Important	Fairly Important	Very Important	Not Important	Somewhat Important	Fairly Important	Very Important
a. Provide concrete experience before abstract concepts.	①	②	③	④	①	②	③	④
b. Develop students' conceptual understanding of the subject.	①	②	③	④	①	②	③	④
c. Take students' prior understanding of subject matter into account when planning curriculum and instruction.	①	②	③	④	①	②	③	④
d. Make connections to other disciplines.	①	②	③	④	①	②	③	④
e. Have students work in cooperative learning groups.	①	②	③	④	①	②	③	④
f. Have students participate in appropriate hands-on activities.	①	②	③	④	①	②	③	④
g. Engage students in inquiry-oriented activities.	①	②	③	④	①	②	③	④
h. Use calculators.	①	②	③	④	①	②	③	④
i. Use computers.	①	②	③	④	①	②	③	④
j. Engage students in applications of subject matter in a variety of contexts.	①	②	③	④	①	②	③	④
k. Use performance-based assessment.	①	②	③	④	①	②	③	④
l. Use portfolios.	①	②	③	④	①	②	③	④
m. Use informal questioning to assess student understanding.	①	②	③	④	①	②	③	④

6. Please rate the effect of each of the following on *mathematics* instruction in your school. (Darken one oval on each line.)

	Inhibits effective instruction		Neutral or mixed		Encourages effective instruction	N/A Don't Know
a. State and/or district curriculum frameworks.	①	②	③	④	⑤	⑥
b. State and/or district testing policies and practices.	①	②	③	④	⑤	⑥
c. District/school grading policies and practices.	①	②	③	④	⑤	⑥
d. District/school structures for recognizing and rewarding teachers.	①	②	③	④	⑤	⑥
e. Counseling department policies and practices.	①	②	③	④	⑤	⑥
f. College placement tests.	①	②	③	④	⑤	⑥
g. Quality of available instructional materials.	①	②	③	④	⑤	⑥
h. Access to calculators for mathematics instruction.	①	②	③	④	⑤	⑥
i. Access to computers for mathematics instruction.	①	②	③	④	⑤	⑥
j. Funds for purchasing equipment and supplies for mathematics.	①	②	③	④	⑤	⑥
k. System of managing instructional resources at the district or school level.	①	②	③	④	⑤	⑥
l. Time available for teachers to plan and prepare lessons.	①	②	③	④	⑤	⑥
m. Time available for teachers to work with other teachers.	①	②	③	④	⑤	⑥
n. Time available for teacher professional development.	①	②	③	④	⑤	⑥
o. Importance that the school places on mathematics.	①	②	③	④	⑤	⑥
p. Consistency of mathematics reform efforts with other school/district reforms.	①	②	③	④	⑤	⑥
q. Public attitudes toward reform.	①	②	③	④	⑤	⑥

7. Please rate the effect of each of the following on *science* instruction in your school. (Darken one oval on each line.)

	Inhibits effective instruction		Neutral or mixed		Encourages effective instruction	N/A Don't Know
a. State and/or district curriculum frameworks.	1	2	3	4	5	NA
b. State and/or district testing policies and practices.	1	2	3	4	5	NA
c. District/school grading policies and practices.	1	2	3	4	5	NA
d. District/school structures for recognizing and rewarding teachers.	1	2	3	4	5	NA
e. Counseling department policies and practices.	1	2	3	4	5	NA
f. College placement tests.	1	2	3	4	5	NA
g. Quality of available instructional materials.	1	2	3	4	5	NA
h. Access to calculators for science instruction.	1	2	3	4	5	NA
i. Access to computers for science instruction.	1	2	3	4	5	NA
j. Funds for purchasing equipment and supplies for science.	1	2	3	4	5	NA
k. System of managing instructional resources at the district or school level.	1	2	3	4	5	NA
l. Time available for teachers to plan and prepare lessons.	1	2	3	4	5	NA
m. Time available for teachers to work with other teachers.	1	2	3	4	5	NA
n. Time available for teacher professional development.	1	2	3	4	5	NA
o. Importance that the school places on science.	1	2	3	4	5	NA
p. Consistency of science reform efforts with other school/district reforms.	1	2	3	4	5	NA
q. Public attitudes toward reform.	1	2	3	4	5	NA

Questions 8-9 refer to the NSF-supported Local Systemic Change (LSC) program. Please refer to the cover letter accompanying this questionnaire for information about the LSC project activities and designated materials in your district.

8. To what extent: (Darken one oval on each line.)

	Not at all				To a great extent	N/A Don't Know
a. Are you familiar with the LSC project in your district?	1	2	3	4	5	DK
b. Have you been involved in LSC project activities?	1	2	3	4	5	DK
c. Have parents voiced support for the LSC approach in the classroom?	1	2	3	4	5	DK
d. Have parents voiced opposition to the LSC approach in the classroom?	1	2	3	4	5	DK

9. *Considering only teachers responsible for teaching the subject(s) targeted by the LSC*, approximately what percent of the teachers in your school: (Darken one oval on each line.)

	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
a. Have been involved in LSC professional development activities?	○	○	○	○	○	○	○	○	○	○	○
b. Are implementing at least some of the LSC-designated instructional materials?	○	○	○	○	○	○	○	○	○	○	○

B. Principal Information

10. Including this year, how many years have you been: (Darken one oval on each line.)

	1	2	3	4	5	6-10	11-15	16-20	21-25	More than 25
a. A principal?	○	○	○	○	○	○	○	○	○	○
b. The principal at this school?	○	○	○	○	○	○	○	○	○	○
c. A principal in this school district?	○	○	○	○	○	○	○	○	○	○

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~ *place label here* ~

C. School Characteristics

11. How many students attend your school? (Please enter your response as a four-digit number and then darken the appropriate oval in each column. For example, enter 850 students as 0850.)

students

12. In what type of community is this school located? (Darken one oval.)

- ○ Rural
- ○ Town or Small City
- ○ Suburban
- ○ Urban

13. This school includes the following grades: (Darken all that apply.)

K	1	2	3	4	5	6
○	○	○	○	○	○	○

7	8	9	10	11	12
○	○	○	○	○	○

14. Approximately what percentage of the students attending this school are: (Please enter each as a three-digit number and then darken the appropriate oval in each column. For example, enter 25 percent as 025; enter less than 1/2 percent as 000.)

a. (the sum of i. & ii. should be 100%)

i. Hispanic or Latino? %

ii. Not Hispanic or Latino? %

b. (the sum of i.-v. should be 100%.)

i. American Indian or Alaskan Native? %

ii. Asian? %

iii. Black or African-American? %

iv. Native Hawaiian or Other Pacific Islander? %

v. White? %

15. What is the estimated percentage of students in this school with limited English proficiency? %

16. What percentage of the students in this school are eligible for free or reduced-price lunches that are paid for with public funds? %

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1998–99 Local Systemic Change
Pre-Classroom Observation Interview

After you have expressed appreciation to the teacher for allowing you to observe the class, ask the following question:

1. What has this class been doing in mathematics/science recently?

   PROBES: What unit are you working on?
   What instructional materials are you using*?

2. What do you anticipate doing in your mathematics/science class on the day I will be observing?

   PROBE: What do you hope students will learn as a result of the work you have planned?

3. What is the next step for this class?

4. Is there anything in particular that I should know about the group of students that I will be observing?

---

* Note that the evaluator will need to be thoroughly conversant with the instructional materials designated for use by the LSC in order to complete the observation ratings.

NOTE: This form is included for information purposes only. Evaluators will need to complete the form on the Web.

1998–99 Local Systemic Change Classroom Observation Protocol[1]

Background Information

Project _____

LSC ID[2] _____

___ Random Sample ___ Backup Sample

___ Other, specify _____

Subject Observed[3] _____

Grade Level _____

Date of Observation _____

Time of Observation:

Start _____ End _____

Observer _____

Observer's Role in Project:

___ Project Evaluator ___ Local Observer

___ Lead

___ Other

Section One: Contextual Background and Activities

In this section, please fill in the circles that best describe the class. ***For each item, be sure to fill in all responses that apply.***

I. Classroom Demographics

A. What is the total number of students in the class at the time of the observation?

- O 15 or fewer
- O 16–20
- O 21–25
- O 26–30
- O 31 or more

B. What is the approximate percentage of white (not Hispanic origin) students in this class?

- O 0–10 percent
- O 11–25 percent
- O 26–50 percent
- O 51–75 percent
- O 76–100 percent

C. Indicate the *teacher's*:

1. Gender
   - O Male O Female
2. Race/Ethnicity
   - O African-American (not Hispanic origin)
   - O American Indian or Alaskan Native
   - O Asian or Pacific Islander
   - O Hispanic
   - O White (not Hispanic origin)
   - O Other

D. If applicable, indicate the *teacher aide's*:

1. Gender
   - O Male O Female
2. Race/Ethnicity
   - O African-American (not Hispanic origin)
   - O American Indian or Alaskan Native
   - O Asian or Pacific Islander
   - O Hispanic
   - O White (not Hispanic origin)
   - O Other

---

[1] Be sure you have read the "1998–99 Local Systemic Change Classroom Observations: Guidelines for Evaluators" and have completed the "Pre-Classroom Observations Interview" before observing the class.

[2] Use the LSC ID number as indicated in the Classroom Observation Sample provided by HRI.

[3] In mathematics/science projects observe the subject for which the teacher was sampled.

II. Classroom Context

A. Rate the adequacy of the physical environment.

1. Classroom resources:

1	2	3	4	5
Sparsely equipped				Rich in resources

2. Classroom Space:

1	2	3	4	5
Crowded				Adequate space

3. Room arrangement:

1	2	3	4	5
Inhibited interactions among students				Facilitated interactions among students

B. In a few sentences, describe the lesson you observed. Include where this lesson fits in the overall unit of study.

III. Purposes of Lesson

A. Indicate the *major*[4] *content area(s)* of this lesson or activity.

- O 1. Numeration and number theory
- O 2. Computation
- O 3. Estimation
- O 4. Measurement
- O 5. Patterns and relationships
- O 6. Pre-algebra
- O 7. Algebra
- O 8. Geometry and spatial sense
- O 9. Functions (including trigonometric functions) and pre-calculus concept
- O 10. Data collection and analysis
- O 11. Probability
- O 12. Statistics (e.g., hypothesis tests, curve-fitting, and regression)
- O 13. Topics from discrete mathematics (e.g., combinatorics, graph theory, recursion)
- O 14. Mathematical structures (e.g., vector spaces, groups, rings, fields)
- O 15. Calculus
- O 16. Life Science (please specify: _____)
- O 17. Physical science (please specify: _____)
- O 18. Earth/space sciences
  - O a. Astronomy
  - O b. Oceanography
  - O c. Geology
  - O d. Meteorology
  - O e. Environmental sciences
- O 19. Engineering and design principles
- O 20. History of mathematics/science
- O 21. None of the above (please explain)

[4] "Major" means was used or addressed for a substantial portion of the lesson; if you were describing the lesson to someone, this feature would help characterize it.

B. Indicate the *primary intended purpose(s)* of this lesson or activity based on the pre- and/or post-observation interviews with the teacher.

- O 1. Identifying prior student knowledge
- O 2. Introducing new concepts
- O 3. Developing conceptual understanding
- O 4. Reviewing mathematics/science concepts
- O 5. Developing problem-solving skills
- O 6. Learning mathematics/science processes, algorithms, or procedures
- O 7. Learning vocabulary/specific facts
- O 8. Practicing computation for mastery
- O 9. Developing appreciation for core ideas in mathematics/science
- O 10. Developing students' awareness of contributions of scientists/mathematicians of diverse backgrounds
- O 11. Assessing student understanding

IV. Instructional Materials

A. Is this lesson based on instructional materials designated for use by this LSC?

O Yes O No, SKIP to Part V below

B. Indicate the *single* set of LSC-designated instructional materials intended to form the basis of this lesson (e.g., FOSS; Insights; STC; Investigations in Number, Data, and Space; Connected Math; IMP; SEPUP), based on the information provided in the pre-observation interview.

Please specify. _____

C. How closely did the lesson adhere to the instructions provided in the teacher's manual?

O Exactly, SKIP to Part V below
O Almost totally O Mostly O Somewhat O A little O Hardly at all

D. How did the adaptations affect the quality of the lesson?

O Helped a lot O Helped a little O Neutral O Hurt a little O Hurt a lot

V. Classroom Instruction

A. Indicate the *major*[5] *way(s)* in which student activities were structured.

O As a whole group O As small groups O As pairs O As individuals

B. Indicate the *major*[5] *way(s)* in which students engaged in class activities.

O Entire class was engaged in the same activities at the same time.
O Groups of students were engaged in different activities at the same time (e.g., centers).

[5] "Major" means was used or addressed for a substantial portion of the lesson; if you were describing the lesson to someone, this feature would help characterize it.

C. Indicate the *major*[6] *activities* of students in this lesson. When choosing an "umbrella" category, be sure to indicate subcategories that apply as well. (For example, if you mark "listened to a presentation," indicate by whom.)

- O 1. Listened to a presentation:
  - O a. By teacher (would include: demonstrations, lectures, media presentations, extensive procedural instructions)
  - O b. By student (would include informal, as well as formal, presentations of their work)
  - O c. By guest speaker/"expert" serving as a resource

- O 2. Engaged in discussion/seminar:
  - O a. Whole group
  - O b. Small groups/pairs

- O 3. Engaged in problem solving/investigation:
  - O a. Worked with manipulatives
  - O b. Played a game to build or review knowledge/skills
  - O c. Followed specific instructions in an investigation
  - O d. Had some latitude in designing an investigation
  - O e. Recorded, represented and/or analyzed data
  - O f. Recognized patterns, cycles or trends
  - O g. Evaluated the validity of arguments or claims
  - O h. Provided an informal justification or formal proof

- O 4. Engaged in reading/reflection/written communication about mathematics or science:
  - O a. Read about mathematics/science
  - O b. Answered textbook/worksheet questions
  - O c. Reflected on readings, activities, or problems individually or in groups
  - O d. Prepared a written report
  - O e. Wrote a description of a plan, procedure, or problem-solving process
  - O f. Wrote reflections in a notebook or journal

- O 5. Used technology/audio-visual resource:
  - O a. To develop conceptual understanding
  - O b. To learn or practice a skill
  - O c. To collect data (e.g., probeware)
  - O d. As an analytic tool (e.g., spreadsheets or data analysis)
  - O e. As a presentation tool
  - O f. For word processing or as a communications tool (e.g., e-mail, Internet, Web)

- O 6. Other activities
  - O a. Arts and crafts activity
  - O b. Listened to a story
  - O c. Wrote a poem or story
  - O d. Other (Please specify.) _____

[6] "Major" means was used or addressed for a substantial portion of the lesson; if you were describing the lesson to someone, this feature would help characterize it.

D. Comments

Please provide any additional information you consider necessary to capture the activities or context of this lesson. Include comments on any feature of the class that is so salient that you need to get it "on the table" right away to help explain your ratings; for example, the class was interrupted by a fire drill, the kids were excited about an upcoming school event, or the teacher's tone was so warm (or so hostile) that it was an overwhelmingly important feature of the lesson.

SECTION TWO: RATINGS

In Section One of this form, you documented what occurred in the lesson. In this section, you are asked to rate each of a number of key indicators in four different categories, from 1 (not at all) to 5 (to a great extent). You may list any additional indicators you consider important in capturing the essence of this lesson and rate these as well. Use your "Ratings of Key Indicators" (Part A) to inform your "Synthesis Ratings" (Part B). It is important to indicate in "Supporting Evidence for Synthesis Ratings" (Part C) what factors were most influential in determining your synthesis ratings and to give specific examples or quotes to illustrate those factors.

Note that any one lesson is not likely to provide evidence for every single indicator; use 6, "Don't know" when there is not enough evidence for you to make a judgment. Use 7, "N/A" (Not Applicable) when you consider the indicator inappropriate given the purpose and context of the lesson. Section Two concludes with ratings of the likely impact of instruction, and a capsule description of the lesson.

I. Design

A. Ratings of Key Indicators

	Not at all				To a great extent	Don't know	N/A
1. The design of the lesson incorporated tasks, roles, and interactions consistent with investigative mathematics/science.	1	2	3	4	5	6	7
2. The design of the lesson reflected careful planning and organization.	1	2	3	4	5	6	7
3. The instructional strategies and activities used in this lesson reflected attention to students' experience, preparedness, and/or learning styles.	1	2	3	4	5	6	7
4. The resources available in this lesson contributed to accomplishing the purposes of the instruction.	1	2	3	4	5	6	7
5. The instructional strategies and activities reflected attention to issues of access, equity, and diversity for students (e.g., use of "wait time," cooperative learning, language-appropriate strategies/materials).	1	2	3	4	5	6	7
6. The design of the lesson encouraged a collaborative approach to learning.	1	2	3	4	5	6	7
7. Adequate time and structure were provided for reflection.	1	2	3	4	5	6	7
8. Adequate time and structure were provided for wrap-up and closure.	1	2	3	4	5	6	7
9. Formal assessments of students were consistent with investigative mathematics/science.	1	2	3	4	5	6	7
10. Design for future instruction takes into account what transpired in the lesson.	1	2	3	4	5	6	7
11. _____	1	2	3	4	5		

B. Synthesis Rating

1	2	3	4	5
Design of the lesson not at all reflective of best practice in mathematics/science education				Design of the lesson extremely reflective of best practice in mathematics/science education

C. Supporting Evidence for Synthesis Rating

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II. Implementation

	Not at all				To a great extent	Don't know	N/A
A. Ratings of Key Indicators							
1. The instruction was consistent with the underlying approach of the instructional materials designated for use by the LSC.	1	2	3	4	5	6	7
2. The instructional strategies were consistent with investigative mathematics/science.	1	2	3	4	5	6	7
3. The teacher appeared confident in his/her ability to teach mathematics/science.	1	2	3	4	5	6	7
4. The teacher's classroom management style/strategies enhanced the quality of the lesson.	1	2	3	4	5	6	7
5. The pace of the lesson was appropriate for the developmental levels/needs of the students and the purposes of the lesson.	1	2	3	4	5	6	7
6. The teacher took into account prior knowledge of students.	1	2	3	4	5	6	7
7. The teacher's questioning strategies were likely to enhance the development of student conceptual understanding/problem solving (e.g., emphasized higher order questions, appropriately used "wait time," identified prior conceptions and misconceptions).	1	2	3	4	5	6	7
8. The lesson was modified as needed based on teacher questioning or other student assessments.	1	2	3	4	5	6	7
9. _____	1	2	3	4	5		

B. Synthesis Rating

1	2	3	4	5
Implementation of the lesson not at all reflective of best practice in mathematics/science education				Implementation of the lesson extremely reflective of best practice in mathematics/science education

C. Supporting Evidence for Synthesis Rating

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III. Mathematics/Science Content

A. Ratings of Key Indicators	Not at all				To a great extent	Don't know	N/A
1. The mathematics/science content was significant and worthwhile.	1	2	3	4	5	6	7
2. The mathematics/science content was appropriate for the developmental level of the students in this class.	1	2	3	4	5	6	7
3. Students were intellectually engaged with important ideas relevant to the focus of the lesson.	1	2	3	4	5	6	7
4. Teacher-presented information was accurate.	1	2	3	4	5	6	7
5. The teacher displayed an understanding of mathematics/science concepts (e.g., in his/her dialogue with students).	1	2	3	4	5	6	7
6. Mathematics/science was portrayed as a dynamic body of knowledge continually enriched by conjecture, investigation analysis, and/or proof/justification.	1	2	3	4	5	6	7
7. Elements of mathematical/science abstraction (e.g., symbolic representations, theory building) were included when it was important to do so.	1	2	3	4	5	6	7
8. Appropriate connections were made to other areas of mathematics/ science, to other disciplines, and/or to real-world contexts.	1	2	3	4	5	6	7
9. The degree of closure or resolution of conceptual understanding was appropriate for the developmental levels/needs of the students and the purposes of the lesson.	1	2	3	4	5	6	7
10. _____	1	2	3	4	5		

B. Synthesis Rating

1	2	3	4	5
Mathematics/science content of lesson not at all reflective of current standards for mathematics/science education				Mathematics/science content of lesson extremely reflective of current standards for mathematics/science education

C. Supporting Evidence for Synthesis Rating

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IV. Classroom Culture

A1. Ratings of Key Indicators

	Not at all				To a great extent	Don't know	N/A
1. Active participation of all was encouraged and valued.	1	2	3	4	5	6	7
2. There was a climate of respect for students' ideas, questions, and contributions.	1	2	3	4	5	6	7
3. Interactions reflected collaborative working relationships among students (e.g., students worked together, talked with each other about the lesson).	1	2	3	4	5	6	7
4. Interactions reflected collaborative working relationships between teacher and students.	1	2	3	4	5	6	7
5. The climate of the lesson encouraged students to generate ideas, questions, conjectures, and/or propositions.	1	2	3	4	5	6	7
6. Intellectual rigor, constructive criticism, and the challenging of ideas were valued.	1	2	3	4	5	6	7
7. _____	1	2	3	4	5		

A2. Respect for Diversity

Based on the culture of a classroom, observers are generally able to make inferences about the extent to which there is an appreciation of diversity among students (e.g., their gender, race/ethnicity, and/or cultural background). While direct evidence that reflects particular sensitivity or insensitivity toward diversity is not often observed, we would like you to document any examples you do see. If any examples were observed, please check here ☐ and describe below:

B. Synthesis Rating

1	2	3	4	5
Classroom culture interferes with student learning				Classroom culture facilitates the learning of all students

C. Supporting Evidence for Synthesis Rating

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V. Overall Ratings of the Lesson

A. Likely Impact of Instruction on Students' Understanding of Mathematics/Science

While the impact of a single lesson may well be limited in scope, it is important to judge whether the lesson is helping move students in the desired direction. For this series of ratings, consider all available information (i.e., your previous ratings of design, implementation, content, and culture, and the pre- and post-observation interviews with the teacher) as you assess the likely impact of this lesson. Feel free to elaborate on ratings with comments in the space provided.

Select the response that best describes your overall assessment of the *likely effect* of this lesson in each of the following areas.

	Negative effect		Mixed or Neutral effect		Positive effect	Don't know	N/A
1. Students' understanding of mathematics/science as a dynamic body of knowledge generated and enriched by investigation.	O	O	O	O	O	O	O
2. Students' understanding of important mathematics/science concepts.	O	O	O	O	O	O	O
3. Students' capacity to carry out their own inquiries.	O	O	O	O	O	O	O
4. Students' ability to apply or generalize skills and concepts to other areas of mathematics/science, other disciplines, and/or real-life situations.	O	O	O	O	O	O	O
5. Students' self-confidence in doing mathematics/science.	O	O	O	O	O	O	O
6. Students' interest in and/or appreciation for the discipline.	O	O	O	O	O	O	O

Comments (optional):

B. Capsule Description of the Quality of the Lesson

In this final rating of the lesson, consider all available information about the lesson, its context and purpose, and your own judgment of the relative importance of the ratings you have made. Select the capsule description that best characterizes the lesson you observed. Keep in mind that this rating is *not* intended to be an average of all the previous ratings, but should encapsulate your overall assessment of the quality and likely impact of the lesson. Please provide a brief rationale for your final capsule description of the lesson in the space provided.

O **Level 1: Ineffective Instruction**
There is little or no evidence of student thinking or engagement with important ideas of mathematics/science. Instruction is *unlikely* to enhance students' understanding of the discipline or to develop their capacity to successfully "do" mathematics/science. Lesson was characterized by either (select one below):

  O **Passive "Learning"**
  Instruction is pedantic and uninspiring. Students are passive recipients of information from the teacher or textbook; material is presented in a way that is inaccessible to many of the students.

  O **Activity for Activity's Sake**
  Students are involved in hands-on activities or other individual or group work, but it appears to be activity for activity's sake. Lesson lacks a clear sense of purpose and/or a clear link to conceptual development.

O **Level 2: Elements of Effective Instruction**
Instruction contains some elements of effective practice, but there are *substantial problems* in the design, implementation, content, and/or appropriateness for many students in the class. For example, the content may lack importance and/or appropriateness; instruction may not successfully address the difficulties that many students are experiencing, etc. Overall, the lesson is *quite limited* in its likelihood to enhance students' understanding of the discipline or to develop their capacity to successfully "do" mathematics/science.

O **Level 3: Beginning Stages of Effective Instruction** (Select one below.)
O Low 3 O Solid 3 O High 3
Instruction is purposeful and characterized by quite a few elements of effective practice. Students are, at times, engaged in meaningful work, but there are *some weaknesses* in the design, implementation, or content of instruction. For example, the teacher may short-circuit a planned exploration by telling students what they "should have found"; instruction may not adequately address the needs of a number of students; or the classroom culture may limit the accessibility or effectiveness of the lesson. Overall, the lesson is *somewhat limited* in its likelihood to enhance students' understanding of the discipline or to develop their capacity to successfully "do" mathematics/science.

O **Level 4: Accomplished, Effective Instruction**
Instruction is purposeful and engaging for most students. Students actively participate in meaningful work (e.g., investigations, teacher presentations, discussions with each other or the teacher, reading). The lesson is well-designed and the teacher implements it well, but adaptation of content or pedagogy in response to student needs and interests is limited. Instruction is *quite likely* to enhance most students' understanding of the discipline and to develop their capacity to successfully "do" mathematics/science.

O **Level 5: Exemplary Instruction**
Instruction is purposeful and all students are highly engaged most or all of the time in meaningful work (e.g., investigation, teacher presentations, discussions with each other or the teacher, reading). The lesson is well-designed and artfully implemented, with flexibility and responsiveness to students' needs and interests. Instruction is *highly likely* to enhance most students' understanding of the discipline and to develop their capacity to successfully "do" mathematics/science.

1998–99 Local Systemic Change
Post-Classroom Observation Interview

After you have expressed appreciation to the teacher for allowing you to observe the class, ask the following questions:

1. Were there any ways in which the lesson was different from what you had planned?

2. What did this lesson tell you about what your students are learning and still need to learn in mathematics/science?

   PROBE: How do you plan to further assess the students' learning?

3. What challenges have you faced in encouraging your students to be actively engaged in this mathematics/science class?

   PROBE: How have you approached these challenges?

4. What is the next step for this class?

1998–99 Local Systemic Change
Pre-Observation Interview with
Professional Development Facilitator

1. Please talk with me briefly about the primary purposes of the professional development session I will be observing.

   PROBE: What do you hope participants will gain as a result of their participation in this session?[1]

2. What do you anticipate happening during the session I will be observing?

   PROBES: Will the session include any of the materials the LSC has designated for classroom use?
   If so, how will they be used?

3. How does this session fit into the sequence of professional development experiences planned for this district's teachers?

   PROBES: What experiences have these participants had with the LSC prior to this session?

   What will they do next?

4. Tell me a little about your background as it relates to the session you will be facilitating.

5. Is there anything in particular that I should know about the participants who will be attending this session?

---

[1] Several of the ratings on the Professional Development Observation Protocol require an understanding of the intended purposes of the session. If the facilitator is not explicit in describing the purposes of the session, further probes may be needed. Additional probes might include direct questions about the extent to which the session is intended to enhance participants' content knowledge, to explore pedagogical strategies/instructional materials or to explore strategies/issues/roles for teacher leaders, principals, or others in leadership positions. Refer to Section One, IIIA on the Professional Development Observation Protocol for a list of potential purposes.

NOTE: This form is included for information purposes only. Evaluators will need to complete the form on the Web.

1998–99 Local Systemic Change Professional Development Observation Protocol[1]

BACKGROUND INFORMATION

Project _____

Location _____

Observer _____

Date of Observation _____

If you are submitting two professional development observations for this date, indicate whether this was the first or second session observed. O 1st O 2nd

Approximate Duration of Observation[2]:
O 1 hour O 3 hours
O 2 hours O half day

Observer's Role in Project: O Lead Evaluator O Other

Subject Targeted by session O Mathematics O Science O Both Mathematics and Science

SECTION ONE: CONTEXTUAL BACKGROUND AND ACTIVITIES

In this section, please fill in the circles that best describe the session. ***For each item, be sure to fill in all responses that apply.***

I. Session Demographics

A. What is the total number of participants attending this session?

O 1–5 O 6–10 O 11–20 O 21–50 O 51–100 O More than 100

B. Please describe the targeted subject(s)/grade level(s)/audience for this professional development session.

1. This session was intended to improve the teaching of: (select all that apply)
   - O Elementary science
   - O Middle grades science
   - O High school science
   - O Elementary mathematics
   - O Middle grades mathematics
   - O High school mathematics

2. Participants were:
   - O Lead teachers for the LSC projects
   - O Other (non-lead) teachers
   - O Administrators
   - O Other (Please specify.) _____

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[1] Be sure you have read the "1998–99 Local Systemic Change Professional Development Observations: Guidelines for Evaluators" and have completed the "Pre-Observation Interview with Professional Development Facilitator" before observing the session.

[2] The observation recorded on this form should be no less than one hour and no more than half a day.

C. Please describe the major presenters/facilitators[3] for this particular one-hour to half-day professional development session.

1. Indicate the number of presenters/facilitators in each gender and race/ethnicity category.

	African-American (not Hispanic-origin)	American Indian or Alaskan Native	Asian or Pacific Islander	Hispanic	White (not Hispanic origin)	Other
Male						
Female						

2. Indicate the number of presenters/facilitators for this particular session with each affiliation.

Regular Full-Time or Part-Time Classroom Teachers	Teachers on Special Assignment[4]	District Mathematics/ Science Supervisor	Other District Personnel	University Mathematics/ Science Faculty	University Mathematics/ Science Education Faculty	Business Industry Mathematicians/ Scientists	Other Non-District Personnel

II. Session Context

In a few sentences, describe the session you observed. Include: (a) whether the observation covered a partial or complete session, (b) whether there were multiple break-out sessions, and (c) where this session fits in the project's sequence of professional development for those in attendance.

III. Session Focus

A. Indicate the *primary intended purpose(s)* of this professional development session based on the information provided by the project staff or session organizer/facilitator.

O 1. Increasing mathematics/science content knowledge of participants. (*Be sure to complete Category III: Mathematics/Science Content and Category VII.A: Likely Impact on Participants' Capacity to Provide High-Quality Mathematics/Science Education, in Section Two of the protocol.*)

O 2. *Explicit* attention to classroom pedagogy/instructional materials. (*Be sure to complete Category IV: Exploring Pedagogy/Instructional Materials and Category VII.A: Likely Impact on Participants' Capacity to Provide High-Quality Mathematics/Science Education, in Section Two of the protocol.*)

- O a. Creating a vision of effective mathematics/science instruction
- O b. Understanding student thinking/learning about mathematics/science content
- O c. Learning how to use specific instructional materials in the classroom
- O d. Learning how to use technology in the classroom.
- O e. Learning pedagogical/classroom management strategies
- O f. Considering issues of access, equity, and diversity
- O g. Designing or scoring student assessments
- O h. Considering issues of scope and sequence (e.g., K-12 curricular frameworks)

O 3. *Explicit* attention to strategies/issues/roles of teacher leaders, principals, or others in leadership positions. (*Be sure to complete Category V: Leadership Content and Category VII.B: Likely Impact on Participants' Leadership Capacity, in Section Two of the protocol.*)

O 4. Other major purposes:

- O a. Orientation to the project
- O b. Assessing participants' knowledge/skills
- O c. Building professional networks among educators
- O d. Promoting/exploring reflective practice
- O e. Developing the capacity of participants to use technology
- O f. Involving administrators and/or other school/district personnel in the reform process

---

[3] In some instances this may not be appropriate, e.g., a session in which a group of teachers meets after school to discuss their action research projects may have no presenters or facilitators. In these instances, please leave the presenters/facilitators cells blank.

[4] Defined as teachers released full-time from classroom responsibilities to work on assignments such as the LSC project.

B. Indicate the *major*[5] *mathematics/science content area(s)* addressed in this professional development session, whether increasing content knowledge was a stated purpose or the mathematics/science content was simply a vehicle for achieving other purposes.

- O 1. Numeration and number theory
- O 2. Computation
- O 3. Estimation
- O 4. Measurement
- O 5. Patterns and relationships
- O 6. Pre-algebra
- O 7. Algebra
- O 8. Geometry and spatial sense
- O 9. Functions (including trigonometric functions) and pre-calculus concepts
- O 10. Data collection and analysis
- O 11. Probability
- O 12. Statistics (e.g., hypothesis tests, curve-fitting, and regression)
- O 13. Topics from discrete mathematics (e.g., combinatorics, graph theory, recursion)
- O 14. Mathematical structures (e.g., vector spaces, groups, rings, fields)
- O 15. Calculus
- O 16. Life Science (Please specify.) _____
- O 17. Physical science (Please specify.) _____
- O 18. Earth/space sciences
  - O a. Astronomy
  - O b. Oceanography
  - O c. Geology
  - O d. Meteorology
  - O e. Environmental science
- O 19. Engineering and design principles
- O 20. History of mathematics/science
- O 21. Mathematics/science as a way of knowing (e.g., inquiry, problem solving)

☐ **Mathematics/science concepts were not included as either an explicit focus or a vehicle for achieving other professional development purposes**

IV. Professional Development Activities

A. Were any of the instructional materials intended for classroom use as part of the LSC (e.g., FOSS; Insights; STC; SEPUP; Investigations in Number, Data, and Space; Connected Math; IMP; Core Plus) a focus of the professional development session?

- O No
- O Yes Please specify. _____

B. Indicate the *major*[5] *activities* of participants in this session. When choosing an "umbrella" category, be sure to indicate subcategories that apply as well. For example, if you mark "formal presentations," indicate by whom.

- O 1. Listened to a formal presentation by:
  - O a. Session presenter/facilitator
  - O b. Participant(s)
- O 2. Engaged in discussions/seminars/reporting out structured as:
  - O a. Entire group led by presenter/facilitator
  - O b. Entire group led by participant(s)
  - O c. Subsets of the group
- O 3. Engaged in problem solving/investigation focusing on disciplinary content, pedagogy, and/or reform issues
- O 4. Read about disciplinary content, pedagogy, or reform issues
- O 5. Wrote about disciplinary content, pedagogy, or reform issues

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[5] "Major" means was used or addressed for a substantial portion of the session; if you were describing the session to someone, this feature would help characterize it.

C. Indicate the major professional development approaches used in this session.[6]

- ○ Workshop/institute/course/seminar
- ○ Receiving formal professional development via technology
- ○ Study groups/"kit clubs"/discussion groups/school-based meetings
- ○ Coaching/mentoring
- ○ Other: _____

D. Comments

Please provide any additional information you consider necessary to capture the activities or context of this professional development session. Include comments on any feature of the session that is so salient that you need to get it "on the table" right away to help explain your ratings.

SECTION TWO: RATINGS

In Section One of this form, you documented what occurred in the session. In this section, you are asked to use that information, as well as any other pertinent observations, to rate each of a number of key indicators in six different categories, from 1 (not at all) to 5 (to a great extent).

Note that any one session is not likely to provide evidence for every single indicator; use 6, "Don't know" when there is not enough evidence for you to make a judgment. Use 7, "N/A" (Not Applicable) when you consider the indicator inappropriate given the purpose and context of the session. For example, a session that focuses on engaging teachers in mathematics/science inquiry may choose not to address classroom applications. In that case, key indicator #7 for Design, "The design of the session provided opportunities for teachers to consider classroom applications of resources, strategies, and techniques," would be rated "N/A," rather than "not at all."

Similarly, there may be entire rating categories that are not applicable to a particular session. For example, categories III, IV, and V (Content) and Overall Ratings VIIA (Impact on Participants' Capacity to Provide High Quality Mathematics/Science Education) and VIIB (Impact on Participants' Leadership Capacity) each have a box to check when the entire rating category is judged to be inappropriate for the session[7]. Categories I (Design), II (Implementation), and VI (Culture of the Professional Development Session) are ones in which specific indicators may be "not applicable," but the overall category should routinely be rated for any observation.

Note that you may list any additional indicators you consider important in capturing the essence of this session and rate these as well.

Use your "Ratings of Key Indicators" (Part A) to inform your "Synthesis Ratings" (Part B). It is important to indicate in "Supporting Evidence for Synthesis Ratings" (Part C) what factors were most influential in determining your synthesis ratings and to give specific examples or quotes to illustrate those factors. Section Two concludes with ratings of the likely impact of professional development, and a capsule description of the session.

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[6] Observers should refer to the Annotated Guide to the Professional Development Observation Protocol for descriptions of each of these professional development approaches.

[7] In most cases, the categories you rate will be consistent with the purposes marked in Section One. Part III.A.1 through 3.

I. Design

A. Ratings of Key Indicators

		Not at all				To a great extent	Don't know	N/A
1.	The design of the session incorporated tasks, roles, and interactions consistent with a spirit of investigation.	1	2	3	4	5	6	7
2.	The instructional strategies and activities used in this session reflected attention to participants' experience, preparedness, and/or learning styles.	1	2	3	4	5	6	7
3.	The session effectively built on participants' knowledge of content, teaching, learning, and/or the reform process.	1	2	3	4	5	6	7
4.	The strategies in this session were appropriate for accomplishing the purposes of the LSC professional development.	1	2	3	4	5	6	7
5.	The design of the session reflected careful planning and organization.	1	2	3	4	5	6	7
6.	The design of the session included "framing" the activity to help participants understand the purpose of the session and where it fits into the larger professional development picture.	1	2	3	4	5	6	7
7.	The design of the session encouraged a collaborative approach to learning.	1	2	3	4	5	6	7
8.	The design of the session provided opportunities for teachers to consider classroom applications of resources, strategies, and techniques.	1	2	3	4	5	6	7
9.	Adequate time and structure were provided for "sense-making," including reflection about concepts, strategies, issues, etc.	1	2	3	4	5	6	7
10.	Adequate time and structure were provided for participants to share experiences and insights.	1	2	3	4	5	6	7
11.	Adequate time and structure were provided for wrap-up and closure.	1	2	3	4	5	6	7
12.	_____	1	2	3	4	5		

B. Synthesis Rating

1	2	3	4	5
Design of the session not at all reflective of best practice for professional development.				Design of the session extremely reflective of best practice for professional development.

C. Supporting Evidence for Synthesis Rating

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II. Implementation

A. Ratings of Key Indicators

	Not at all				To a great extent	Don't know	N/A
1. Formal presentations included in the session were carried out effectively.	1	2	3	4	5	6	7
2. The facilitator(s)' contributions during the course of the session enhanced the quality of the session.	1	2	3	4	5	6	7
3. The facilitator(s) effectively modeled questioning strategies that are likely to enhance the development of conceptual understanding (e.g., emphasis on higher-order questions, appropriate use of "wait time," identifying prior conceptions and misconceptions.)	1	2	3	4	5	6	7
4. The facilitator(s)' background, experience, and/or expertise enhanced the quality of the session.	1	2	3	4	5	6	7
5. The facilitator(s)' management style enhanced the quality of the session.	1	2	3	4	5	6	7
6. The pace of the session was appropriate for the purposes of the professional development and the needs of adult learners.	1	2	3	4	5	6	7
7. The session modeled effective assessment strategies.	1	2	3	4	5	6	7
8. _____	1	2	3	4	5		

B. Synthesis Rating

1	2	3	4	5
Implementation of the session not at all reflective of best practice for professional development.				Implementation of the session extremely reflective of best practice for professional development

C. Supporting Evidence for Synthesis Rating

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III. Mathematics/Science Content

Complete this category if: a) increasing mathematics/science content knowledge was a key purpose of the session; b) mathematics/science content was a vehicle for accomplishing other professional development purposes; or c) inadequate coverage in this area acted as a barrier to accomplishing other stated purposes of the session. If none of these apply, check here ☐ and skip to category IV.

A. Ratings of Key Indicators

	Not at all				To a great extent	Don't know	N/A
1. Mathematics/science content was appropriate for the purposes of the professional development session and the backgrounds of the participants.	1	2	3	4	5	6	7
2. Mathematics/science content was sound and appropriately presented/explored.	1	2	3	4	5	6	7
3. Participants were intellectually engaged with important ideas relevant to the focus of the session.	1	2	3	4	5	6	7
4. Facilitator(s) displayed an understanding of mathematics/science concepts (e.g., in their dialogue with participants).	1	2	3	4	5	6	7
5. Mathematics/science was portrayed as a dynamic body of knowledge continually enriched by conjecture, investigation, analysis, and/or proof/justification.	1	2	3	4	5	6	7
6. Depth and breadth of attention to mathematics/science content was appropriate for the purposes of the session and participants' needs.	1	2	3	4	5	6	7
7. Elements of mathematical/scientific abstraction (e.g., symbolic representations, theory building) were included when it was important to do so.	1	2	3	4	5	6	7
8. Appropriate connections were made to other areas of mathematics/ science, to other disciplines, and/or to real-world contexts.	1	2	3	4	5	6	7
9. Degree of closure or resolution of mathematics/science conceptual understanding was appropriate for the purposes of the session and the needs of adult learners.	1	2	3	4	5	6	7
10. _____	1	2	3	4	5		

B. Synthesis Rating

1	2	3	4	5
Mathematics/science content of session not at all reflective of current standards for mathematics/science education				Mathematics/science content of session extremely reflective of current standards for mathematics/science education

C. Supporting Evidence for Synthesis Rating

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IV. Exploring Pedagogy/Instructional Materials

Complete this category if: a) exploring classroom practice/instructional materials was a key purpose of the session; or b) lack of/inadequate coverage in this area acted as a barrier to accomplishing other stated purposes of the session. If neither of these apply, check here ☐ and skip to category V.

A. Ratings of Key Indicators

	Not at all				To a great extent	Don't know	N/A
1. Depth and breadth of attention to student thinking/learning were appropriate for the purposes of the session and participants' needs.	1	2	3	4	5	6	7
2. Depth and breadth of attention to classroom strategies were appropriate for the purposes of the session and participants' needs.	1	2	3	4	5	6	7
3. Depth and breadth of attention to instructional materials intended for classroom use were appropriate for the purposes of the session and participants' needs.	1	2	3	4	5	6	7
4. Facilitator(s) displayed an understanding of pedagogical concepts (e.g., in their dialogue with participants).	1	2	3	4	5	6	7
5. Participants were intellectually engaged with important ideas relevant to classroom practice.	1	2	3	4	5	6	7
6. Degree of closure or resolution of conceptual understanding about classroom practice was appropriate for the purposes of the session and the needs of adult learners.	1	2	3	4	5	6	7
7. _____	1	2	3	4	5		

B. Synthesis Rating

1	2	3	4	5
Pedagogical content of session not at all reflective of current standards for mathematics/science education				Pedagogical content of session extremely reflective of current standards for mathematics/science education

C. Supporting Evidence for Synthesis Rating

V. Leadership Content

Complete this category only if exploring strategies/issues/roles of teacher leaders, principals, or others in leadership positions was a key purpose of the session. If not, check here ☐ and skip to category VI.

A. Ratings of Key Indicators	Not at all				To a great extent	Don't know	N/A
1. Information on principles of effective staff development was sound and appropriately presented/explored.	1	2	3	4	5	6	7
2. Information on strategies for mentoring/coaching peers was sound and appropriately presented/explored.	1	2	3	4	5	6	7
3. Information on how to be a reform advocate at school/district level was sound and appropriately presented/explored.	1	2	3	4	5	6	7
4. Facilitator(s) displayed an understanding of leadership concepts (e.g., in their dialogue with participants).	1	2	3	4	5	6	7
5. Participants were intellectually engaged with important ideas relevant to the focus of the session.	1	2	3	4	5	6	7
6. Participants were given adequate and appropriate opportunity to consider how the content of the session applies to their particular leadership roles.	1	2	3	4	5	6	7
7. _____	1	2	3	4	5		

B. Synthesis Rating

1	2	3	4	5
Leadership content not at all appropriate for preparing participants to be school/district leaders of mathematics/science education				Leadership content highly appropriate for preparing participants to be school/district leaders of mathematics/science education

C. Supporting Evidence for Synthesis Rating

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VI. Culture of the Professional Development Session

A1. Ratings of Key Indicators

	Not at all				To a great extent	Don't know	N/A
1. Active participation of all was encouraged and valued.	1	2	3	4	5	6	7
2. There was a climate of respect for participants' experiences, ideas, and contributions.	1	2	3	4	5	6	7
3. Interactions reflected collaborative working relationships among participants.	1	2	3	4	5	6	7
4. Interactions reflected collaborative working relationships between facilitator(s) and participants.	1	2	3	4	5	6	7
5. Participants were encouraged to generate ideas, questions, conjectures, and propositions.	1	2	3	4	5	6	7
6. Intellectual rigor, constructive criticism, and the challenging of ideas were valued.	1	2	3	4	5	6	7
7. Investigation and risk-taking were valued.	1	2	3	4	5	6	7

A2. Respect for Diversity

Based on the culture of a professional development session, observers are generally able to make inferences about the extent to which there is an appreciation of diversity among participants (e.g., their gender, race/ethnicity, and/or cultural background). While direct evidence that reflects particular sensitivity or insensitivity toward diversity is not often observed, we would like you to document any examples you do see. If any examples were observed, please check here ☐ and describe below:

B. Synthesis Rating

1	2	3	4	5
Culture of the session interferes with engagement of participants as members of a professional learning community				Culture of the session facilitates engagement of participants as members of a professional learning community

C. Supporting Evidence for Synthesis Rating

VII. Overall Ratings of the Session

While the impact of a single professional development session may well be limited in scope, it is important to judge whether the session is helping move participants in the desired direction. For ratings in Sections A and B below, consider all available information (i.e., your previous ratings of design, implementation, content, and culture; related interviews; and your knowledge of the overall professional development program) as you assess the likely impact of this session. Feel free to elaborate on ratings with comments in the space provided.

A. Likely Impact on Participants' Capacity to Provide High Quality Mathematics/Science Education

Consider the likely impact of this session on the participants' capacity to provide high quality mathematics/science education. Select the response that best describes your overall assessment of the *likely effect* of this session in each of the following areas.

☐ Not applicable (The session did not focus on building capacity for classroom instruction.)

	Negative effect		Mixed or Neutral effect		Positive effect	Don't know	N/A
1. Participants' ability to identify and understand important ideas of mathematics/science.	○	○	○	○	○	○	○
2. Participants' understanding of mathematics/science as a dynamic body of knowledge generated and enriched by investigation.	○	○	○	○	○	○	○
3. Participants' understanding of how students learn.	○	○	○	○	○	○	○
4. Participants' ability to plan/provide high quality mathematics/ science classroom instruction.	○	○	○	○	○	○	○
5. Participants' ability to implement the designated instructional materials.	○	○	○	○	○	○	○
6. Participants' self-confidence as mathematics/science instructors.	○	○	○	○	○	○	○
7. Professional networking among participants with regard to mathematics/science instruction.	○	○	○	○	○	○	○

Comments (optional):

B. Likely Impact on Participants' Leadership Capacity

If the session included any teacher leaders, principals, or others in leadership positions, consider the likely impact of this session on their leadership capacity. Select the response that best describes your overall assessment of the *likely effect* of this session in each of the following areas. Please note that even if an element was not addressed explicitly, it might have a negative or positive effect on leadership development, depending on whether it was modeled well or poorly.

☐ Not applicable (The session did not include teacher leaders, principals, or others in leadership positions.)

	Negative effect		Mixed or Neutral effect		Positive effect	Don't know	N/A
1. Leaders' knowledge and understanding of mathematics/science.	O	O	O	O	O	O	O
2. Leaders' knowledge and understanding of effective classroom practice.	O	O	O	O	O	O	O
3. Leaders' ability to convey to others a vision of effective mathematics/science classrooms.	O	O	O	O	O	O	O
4. Leaders' understanding of teachers' prior knowledge and areas where teachers have difficulty.	O	O	O	O	O	O	O
5. Leaders' understanding of adult learners.	O	O	O	O	O	O	O
6. Leaders' understanding of the reform process.	O	O	O	O	O	O	O
7. Leaders' understanding of important strategies for reform of mathematics/science education.	O	O	O	O	O	O	O
8. Leaders' ability to plan/implement exemplary professional development.	O	O	O	O	O	O	O
9. Leaders' confidence in serving in leadership roles.	O	O	O	O	O	O	O
10. Professional networking among leaders with regard to leadership issues.	O	O	O	O	O	O	O

Comments (optional):

C. Capsule Description of the Quality of the Professional Development Session

In this final rating of the session, consider all available information about the session, its context and purpose, and your own judgment of the relative importance of the ratings you have made. Select the capsule description that best characterizes the session you observed. Keep in mind that this rating is *not* intended to be an average of all the previous ratings, but should encapsulate your overall assessment of the quality and likely impact of the session. Please provide a brief rationale for your final capsule description of the session in the space provided.

- O **Level 1: Ineffective Professional Development**
  There is little or no evidence of participant thinking or engagement with important ideas of mathematics/science education. Session is *unlikely* to enhance the capacity of participants to provide high quality mathematics/science education or to be effective leaders of mathematics/science education in the district(s). Professional development appears to be either (select one below):
  - O **Passive "Learning"**
    Session is pedantic and uninspiring. Participants are passive recipients of information; material is presented in a way that is inaccessible to or inappropriate for many of the participants.
  - O **Activity for Activity's Sake**
    Participants are involved in hands-on activities or other individual or group work, but it appears to be activity for activity's sake. Session lacks a clear sense of purpose and/or a clear link to the conceptual development of participants.

- O **Level 2: Elements of Effective Professional Development**
  Session contains some elements of effective practice in professional development, but there are *substantial problems* in the design, content, and/or implementation given the purposes of the session. For example, the content is presented in a way that would reinforce misconceptions or the pace is clearly too rapid for meaningful participant engagement. Overall, the session is *quite limited* in its likelihood to enhance the capacity of most participants to provide high quality mathematics/science education or to be effective leaders of mathematics/science education in the district(s).

- O **Level 3: Beginning Stages of Effective Professional Development** (Select one below.)
  O Low 3 O Solid 3 O High 3
  Professional development is purposeful and at times effective, but there are *some weaknesses* in the design, content, or implementation of the session. For example, participants' expertise is not well-utilized; or participants are not given sufficient opportunity to reflect on what they are learning. Overall, the session is *somewhat limited* in its likelihood to enhance the capacity of participants to provide high quality mathematics/science education or to be effective leaders of mathematics/science education in the district(s).

- O **Level 4: Accomplished, Effective Professional Development**
  Facilitation is skillful and participants are engaged in purposeful work (e.g., investigations, discussions, presentations, reading) designed to deepen their understanding of important mathematics/science concepts; enhance their pedagogical skills and knowledge; increase their ability to use the designated instructional materials; or to enhance their leadership skills. The facilitator(s) implement the professional development session well and participants' contributions are valued, but adaptation of content or format in response to participants' needs and interests may be somewhat limited. The session is *quite likely* to enhance the capacity of most participants to provide high quality mathematics/science education or to be effective leaders of mathematics/science education in the district(s).

- O **Level 5: Exemplary Professional Development**
  Facilitation is skillful, and participants are highly engaged in purposeful work (e.g., investigations, discussions, presentations, reading) designed to deepen their understanding of important mathematics/science concepts; enhance their pedagogical skills and knowledge; increase their ability to use the designated instructional materials; or to enhance their leadership skills. The session is artfully implemented, with flexibility and responsiveness to participant needs/interests. The session is *highly likely* to enhance the capacity of participants to provide high quality mathematics/science education or to be effective leaders of mathematics/science education in the district(s).

Please provide your rationale for the capsule rating:

Austin Independent School District

Superintendent of Schools
Pascal Forgione, Jr., Ph.D.

Deputy Superintendent
Joy McLarty, Ph.D.

Department of Mathematics
Norma Jost, Interim Administrative Supervisor

Department of Accountability
Maria Whitsett, Ph.D., Director

Office of Program Evaluation
Holly Williams, Ph.D., Assistant Director

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